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CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



CULBERT L. OLSON, *Governor of California*

JANUARY • 1939

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

Published for information of the members of the department and the citizens of California

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JANUARY, 1939

No. 1

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Highway Funds Inadequate to Take Care of Increased Transportation Demands Arising in District VIII

By E. Q. SULLIVAN, District Engineer

STATE Highway District VIII comprises the area occupied by San Bernardino County and the populous western half of Riverside County. (The eastern half of Riverside County is included in District XI.) The mileage of State highways in the district is approximately 1340 miles, of which 93 miles are within the limits of incorporated cities. This mileage is approximately 10 per cent of the total of the State Highway System.

Topography of District VIII is such that we have valley, foothill, mountain and desert roads. Climatic conditions vary from the extreme summer heat of the desert to extreme winter cold and snow in the mountain area.

The status of improvement of the roads in the district, exclusive of bridge decks and city streets, is:

33 miles, or 2.7%, unimproved and unoled earth roads.

700 miles, or 56.1%, temporary oil surfacing and obsolete pavements, inferior as to grade and alignment.

410 miles, or 32.9%, intermediate type surface.

104 miles, or 8.3%, high type pavement.

There are 333 bridges in the district with a total length of 25,300 lineal feet, or 4.8 miles.

There are 58 railroad grade crossings and 14 grade separation structures in the district. Many of the grade crossings on important routes are extremely hazardous and should be eliminated.

Much of the mileage of highways in District VIII consists of roads taken over from the counties. It was the custom of counties for a great many years to construct "dips" in place of bridges and culverts, in view of the light traffic and slow movement of vehicles. This custom was also followed in the early construction of some of the light traffic State highways, though in late years, because of increased volume of traffic and greatly increased speed of traffic, the construction of highways containing "dips" has been discontinued. There are now in District VIII approximately 450 miles of highway where "dips" are the principal provision for water crossing the highways. "Dips" in the original highways served fairly well when the maximum speed permitted by the law was 30 miles per hour, but with the present high speed of motor vehicles, every "dip" is a potential menace and must be eliminated at the earliest possible time.

The close proximity of the Los Angeles metropolitan area has started the development of "ribbon cities" along the principal highways entering District VIII from Los Angeles area. This development has made mandatory the early securing of wide rights of way. Ten years ago rights of way were donated by the abutting property owners because

Road Building Lags Behind Traffic Rise



Top—Dips on Highland Avenue on Route 190, San Bernardino. Center—Narrow bridge on Base Line Avenue between San Bernardino and Redlands. Bottom—Winding grade near summit leading from Cajon Pass to Lake Arrowhead.

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FRANK W. CLARK, Director of Public Works

Frank W. Clark Takes Office As Director of Public Works

AN AUTHORITY on the construction of highways, dams, levees and public buildings and a student of flood control, irrigation and drainage work, Frank W. Clark, for many years a business executive of Los Angeles, this month assumed the duties of Director of the Department of Public Works.

Mr. Clark has relinquished his private business interests to devote his entire attention to State service. Drafted into his new position by Governor Culbert L. Olson, Mr. Clark, long interested in governmental affairs, has accepted public office for the first time. He succeeds Earl Lee Kelly, resigned.

In a formal statement announcing the appointment of his Director of Public Works, Governor Olson said:

OFFICE SOUGHT THE MAN

"My selection of Frank W. Clark for the position of Director of Public Works is a case of the office seeking the man. I feel that I am fortunate and that the State is fortunate in securing the service of Mr. Clark.

"I have been personally acquainted with Mr. Clark for about 15 years. He is a man of unquestioned integrity, high ideals and sincerity of purpose; and he has enjoyed that reputation throughout his active life in the field of industry.

"He is 46 years of age; has been a resident of California for 34 years. His education, training and experience especially qualify him for this position.

FAMILIAR WITH PROBLEMS

"He has had years of experience in, and is familiar with, all phases of construction work, including highway and road building, dam and levee construction, public buildings and all forms of flood control, irrigation and drainage work; in connection with all of which he has been an eminently successful business executive.



Entrance to Public Works Building in Sacramento

He is familiar with the problems both physical and financial, of all California's irrigation districts now in great need of constructive State services.

"He has never sought public office, but has taken a deep interest in the cause of progressive government; and it is a gratifying circumstance to me that he has always been liberal in his political philosophy, and is an ardent, progressive Democrat.

HONOR TO SERVE STATE

"In taking this position, Mr. Clark is disassociating himself from all private business interests and connections. His sole interest will be to give to the State of California the splendid service he is competent to render in our Department of Public Works.

"I do not believe any State appointee ever took office in California with a more thorough knowledge of its duties and with greater ability to perform them than has Mr. Clark for this position."

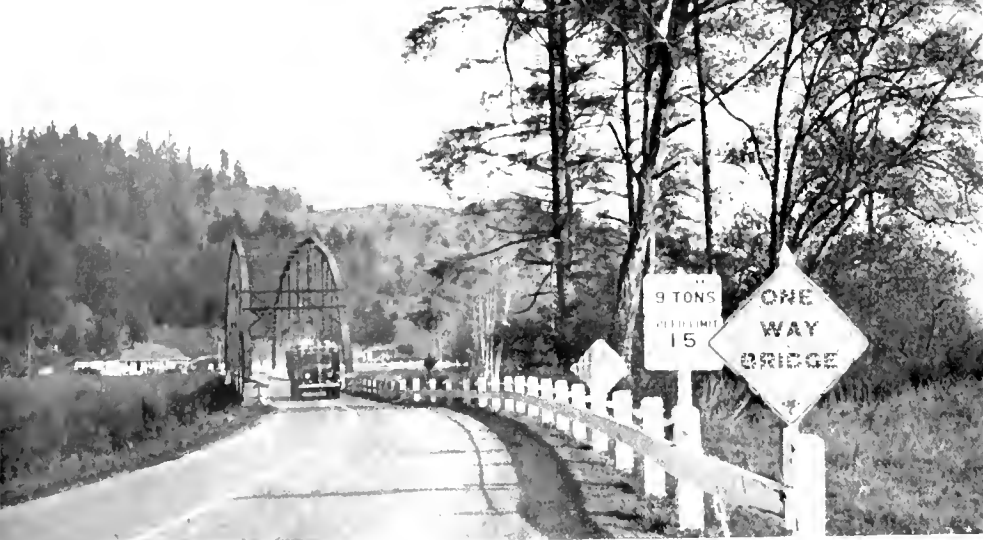
In accepting the appointment, Mr. Clark said:

"I know our new Governor well. He knows me. We both recognize the magnitude and importance of the office of Director of the Department of Public Works.

"I feel certain that if Governor Olson had not felt confident I would honestly and could efficiently handle the affairs of this important department, he would not have asked me to be its director.

"If I had not believed the manner in which I will fulfill the duties of this office would at all times reflect further credit upon the administration of Governor Olson I would not have accepted the appointment.

"I fully appreciate the honor and am grateful for the privilege of serving the people of California under this truly great man.



Top—Narrow posted bridge on Arcata to Redding highway, 3 miles east of Arcata. About 1800 vehicles use this bridge each day. Center—Sharp, reversing curves on steep grade two miles south of Orick on Redwood Highway. Bottom—Narrow, one-way suspension bridge, 15 miles east of Arcata on Arcata to Redding highway.

Many Roads in D

By E. R. GREE

THE northwestern portion of the State, widely known as the Redwood Empire, including the counties of Lake, Mendocino, Humboldt, Del Norte, and portions of Siskiyou and Trinity, comprise the territory within State Highway District I.

The entire area is mountainous and quite rugged with consequent high cost per mile in constructing highways adequate for modern traffic needs. For this reason it is an undeniable fact that reconstruction of State highways, both primary and secondary, to modern or even adequate standards has not kept pace with requirements of the motoring public.

District I has the unenviable distinction of having within its borders a disproportionate large percentage of unoiled road surfaces that now remain in the State Highway System. The entire district is subject to extremely heavy rainfall, being well over 100 inches in many portions during the winter of 1937-38 and at one recording station only, that being in Lake County, was the rainfall less than 50 inches. Precipitation in this amount combined with heavy grading makes slides inevitable. The removal of these slides alone places a heavy burden on the already overtaxed finances of the Department as can be readily understood when it is to be noted that the cost of this item in District I amounted to \$599,357 as a result of the wet winter of 1937-38.

Inadequate road surfacing throughout the district and snow removal in many portions further add to maintenance costs, which costs necessarily defer much needed reconstruction of obsolete highways, railroad grade sep-



Top—Sharp curves onto narrow bridge across Long Valley Creek on Redwood Highway between Willits and Laytonville. Center—Scene of many accidents on Redwood Highway one-half mile north of Richardson's Grove. Bottom—Sharp curve 8 miles north of Garberville on Redwood Highway. Summer traffic is 3500 cars per day on this section.

District I Inadequate

District Engineer

arations, and a staggering number of entirely inadequate bridges.

The chief industry and products of the Redwood Empire are lumbering, dairy products, fisheries, stock raising, and in the southern portion, fruit and wines, the greater part of which must reach their market by use of the Redwood Highway, U. S. 101. Rail service is not at all dependable during the winter season. The Northwestern Pacific, the only railroad serving this territory, was out of service by reason of slides and washouts from November 9 to November 25, December 10 to December 28, and from February 3 to April 16 during the past winter. During this period the entire area tributary to the northern 200 miles was wholly dependent on this one highway for its transportation system.

Before the completion of the Northwestern Pacific Railroad to Eureka in 1915 and the Redwood Highway in 1918, Humboldt, Del Norte, the western portions of Siskiyou and Trinity counties, and the northern portion of Mendocino County were served by a fleet of coastal steamers, but this service has been discontinued since that date except for a very limited number wholly engaged in the transportation of lumber, and State Highways, principally the Redwood Highway, have assumed the major burden of all transportation.

From the above facts it is convincingly apparent that this arterial highway, comprising 325 miles of the total of 365 miles of primary mileage in the district, must be modernized and brought to adequate standards as fast as available funds will permit; first, because it is indispensable

(Continued on page 17)





1—Section of Benton Road, Route 40, Mono County. 2—Box Canyon on Westgard Pass, Inyo County, too narrow for safety. 3—This Section of Route 40 near Mono Mills, connects U. S. 6 and Yosemite National Park. 4—Narrow, crooked road through June Lake Village in Mono County.

District IX Needs \$19,000,000

By S. W. LOWDEN, Acting District Engineer

THE area comprising District IX of the Division of Highways extends 330 miles northerly from the Los Angeles County line on the Mojave Desert to the Alpine County line near Topaz Lake. Bordering the westerly district boundary are the crests of the Sierra Nevada Mountain Range containing a number of the highest peaks in the continental United States. The eastern boundary follows the California-Nevada state boundary to a point 25 miles northerly of Calada near the Barstow-Las Vegas Highway.

Encompassed within this gigantic triangle are 18,756 square miles, or 12 per cent of the entire area of the State of California included within the counties of Inyo, Mono and a portion of Kern.

The problem of providing an adequate highway service to this area is of particular interest to the highway engineer. The highways traversing this land of contrast are so diversified as to constitute an entire range from extreme desert conditions to the ruggedness of the High Sierra, and from depressions below sea level to elevations of 10,000 feet.

This diversity of physical characteristics requires a very thorough study in order that the utmost in economy of expenditure consistent with maximum safety and service may be obtained. In portions of the district rain or snow is practically unknown while in the mountainous sections it is not uncommon to encounter snow drifts reaching depths of 25 to 40 feet.

The temperature range has a great influence on the cost of highway operations both from a construction and maintenance standpoint.

Authentic readings indicate that a high of 134 degrees F. has been recorded in Death Valley in the eastern portion of the district while ranges from 120 degrees F. to 125 degrees F. are encountered each season. For the low, the record is at Bridgeport, where a minus 46 degree F. has of recent years been reached, while minus 30 degrees to 35 degrees is of frequent occurrence.

The mileage of the State Highway System within the district is 800 miles, or approximately 6 per cent of the State total that have been brought to the following standards of improvement.

	Miles considered
Unimproved and unoled earth roads.....	100
Oiled earth roads inadequate as to width, alignment and grades	530
Intermediate type surface with satisfactory width, alignment and grades for present demands but soon requiring restoration of surface and increased safety provisions	170
Total	800
34 Bridges unsatisfactory as to width and structurally.....	
10 Bridges satisfactory for present service.....	
Drainage Dips requiring reconstruction to satisfactorily serve present traffic demands.....	1.0

The highways of the district render a variety of services, the principal route being a portion of the 3 Flags Highways (U. S. 395), extending from Canada to Mexico. Within California this portion connects the city of Reno with the city of Los Angeles as well as carrying a heavy traffic from the western States of Oregon, Washington, Idaho, Utah, Montana and Wyoming.

(Continued on page 11)

Road Funds Inadequate to Care for Traffic Increases

(Continued from page 1)

of the benefit to abutting property by the construction of highways. The development of "ribbon cities" along the highways has made impossible the securing of right of way by donation and the widening of rights of way has become an extremely difficult and costly procedure.

Light rainfall and excellent subgrade conditions for most of the area in District VIII has in the past made possible the use of light bituminous surfaces. With a continued increase of heavier truck loads and greater numbers of trucks to serve the metropolitan area, these light surfaces will have to be replaced with heavier pavements.

Bridge construction in District VIII is not keeping up with requirements. A number of bridge decks and the approaches are obsolete and entirely inadequate to serve traffic properly. Narrow bridges with restricted sight distance are prevalent.

It is estimated that to put the roads and bridges in District VIII in condition to adequately serve present traffic and construct essential grade separations, would require:

720 miles of new construction, totaling \$31,300,000.

217 miles of reconstruction, totaling \$5,800,000.

10,500 lineal feet of bridges, totaling \$2,450,000.

10 grade separation structures, totaling \$800,000.

The grand total required is \$40,350,000.

District VIII is bordered on the west by Los Angeles County. The county line is only thirty-three miles from the Los Angeles City Hall. Three transcontinental highways entering Southern California and terminating in Los Angeles, cross District VIII. There is an ever increasing flow of traffic on these transcontinental highways.

The San Jacinto mountain resorts in Riverside County and the San Bernardino mountain resorts in San Bernardino County are each about two hours' drive from the center of Los Angeles. These mountain resorts have the largest concentration of mountain homes of any similar National Forest area in the United States. This vast pleasure area must be provided with adequate highways.

During the past few years there has been a remarkable recreational development in the desert regions of District VIII. Palm Springs, Twenty-Nine Palms and the North Mojave Desert are becoming more popular each year. These regions are about a three-hour trip from Los Angeles and heavy winter traffic shuttles back and forth between these desert home areas and Los Angeles in ever increasing volume.

Added to this, is the rapidly increasing truck traffic crossing District VIII from the Imperial Valley. There are also increasing numbers of freight trucks hauling manufactured articles from the Los Angeles factories to supply Arizona and Nevada.

It is apparent that sufficient construction funds can not be obtained to provide the needs of the immediate future. The continuously increasing demands of traffic are such that it seems imperative that something must be done to increase construction funds to at least keep pace with the increasing demands.



1—Winding grades and hairpin turns on Carbon Canyon Road, San Bernardino County. 2—Narrow bridge connecting Cajon Pass with San Bernardino Mountain resorts 3—Winding, narrow dirt road between Camp Seeley and Cedar Springs. 4—Sharp curve and poor sight distance.



View of divided highway on U. S. 99 south of Bakersfield showing new lanes for southbound traffic on left separated from old highway by 26-foot strip. Islands for channelization of traffic mark the Maricopa-Taft intersection.

New Divided Highway Dedicated

WITH State dignitaries, officials of three southern San Joaquin Valley counties and representative citizens from many sections of California participating, ceremonies celebrating the completion of the nineteen-mile stretch of four-lane divided highway on U. S. 99 between Bakersfield and Grapevine were held at the northern end of the project, eleven miles south of Bakersfield, on December 16, last.

Following a luncheon given by the Kern County Chamber of Commerce, a cavalcade of automobiles filled with celebrants proceeded to the scene of the dedicatory exercises where former Governor Frank P. Merriam officially opened the new highway.

Construction of the four-lane pavement between Bakersfield and Grapevine, divided by a wide tree-planted strip, brings to motorists more safety and driving comfort, and the longest stretch of divided highway in the State. To drive for miles without meeting a vehicle coming from the opposite direction does much to relieve the strain of driving. Particu-

larly is this true at night. On the new highway there will be no head-light glare of approaching vehicles and cars to be overtaken can be seen at much greater distances.

These advantages have been made possible by the construction of a highway with 23 feet of asphaltic concrete pavement parallel to the existing route. Twenty-six feet separates the pavement carrying north bound traffic from the new pavement which is used exclusively for south bound traffic.

Along a large portion of this 26-foot dividing strip are trees planted over twenty years ago, which were brought to maturity in this semi-arid area only after great difficulty and expense. These trees, planted by Kern County shortly after the original State Highway was constructed, are of many varieties including Black Walnut, Olives and Palms.

Planted as a highway improvement project and to furnish shade to motorists wishing to park under their branches, the trees now play an important part on this modern divided

highway. So completely do they serve as a screen between the north bound and south bound traffic that all head light glare is eliminated.

With the divided one-way highways a great saving in time and patience has been accomplished. It is no longer necessary to trail a slow moving truck, waiting for a chance to get out in the lane of approaching traffic, and run ahead of the low speed vehicle.

Nearly 17 per cent of the vehicles using this highway are trucks. Traffic on the route has increased steadily since the original highway was constructed in 1915. In 1918 a traffic count showed 398 vehicles in 16 hours; by 1928 the number of vehicles had increased to 2526.

During the next ten years the traffic more than doubled for the 1938 count recorded 5685 vehicles. What the next ten years will bring we can only guess, but we are sure that the increase will be considerable.

The 19 miles of divided highway is only a link in the great transpor-

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Two views of divided highway on U. S. 99 south of Bakersfield. The upper picture looking south shows the point where the curbed, crushed stone narrow dividing strip ends and wider tree covered separation divides the two lanes. In lower picture the dividing strip is located at center of old highway. Here the State owned wide, tree-bordered right of way that permitted extra traffic lanes to be built.



The new lanes for southbound traffic, at left, just added to the divided highway south of Bakersfield are shown at a point where they are separated at a different level from the old highway on right now reserved for northbound traffic.

tation route, U. S. 99, which connects the Metropolitan Area of Los Angeles and the Port of Los Angeles with the productive San Joaquin and Sacramento Valleys, and the San Francisco Bay region.

The opening of the new improvement was naturally of great interest to the people of Kern and other counties in the San Joaquin Valley and many turned out to attend the ceremony. A chain of artificial wild flowers held by three little girls was stretched across the new highway. The picking of a flower in this chain by former Governor Merriam broke the barrier and officially opened the new highway.

A 100-piece band from Kern County Union High School and Junior College furnished musical selections. Also participating in the ceremony were the Kern County Rangers, led by Captain Grady Cowart.

Alfred Harrell presided over the ceremony. Mr. Merriam and Harry A. Hopkins of Taft, ex-Assistant Director of Public Works, were the principal speakers.

Those present at the celebration included H. R. Judah, chairman, and Philip A. Stanton, of the State Highway Commission; E. E. East, Chief Highway Engineer of the Automobile Club of Southern California; C. E.

McStay, Field Secretary of the Automobile Club; Assemblyman Gordon Garland, representing Tulare and Kings counties; J. G. Brown and C. B. Allenbaugh, Supervisors of Tulare County; Assemblyman Rodney Turner and State Senator J. L. Wagy of Kern County; R. M. Gillis, Construction Engineer, State Division of Highways, Sacramento; S. W. Lowden, Acting District Engineer, State Division of Highways, Bishop; R. S. Badger, District Construction Engineer, Fresno; W. A. Collins, Chairman of the San Joaquin Council, State Chamber of Commerce; Supervisors Roy Woollones, Stanley Abel, Jay Hinman and George Parish of Kern County; J. R. Benedict, president of the Lindsay Chamber of Commerce, and Walter Drameck, president of the Visalia Chamber of Commerce.

In addition to the many county officials, representatives from several cities and others attended, including J. J. Philippe, Visalia City Manager; Fred Nighbert, Bakersfield City Manager; L. D. Bachelder, president of the Airline Highway Association; Charles Anger, manager of the Central California Tourist Association; Wesley Walden, commander of Frank S. Reynolds Post, American Legion; Floyd Howe, Secretary of the Coal-

inga Chamber of Commerce, and Herbert Arndt, secretary of the Taft Chamber of Commerce.

Arrangements for the ceremony were made by Emory Gay Hoffman, secretary of the Kern County Chamber of Commerce, and Norman P. Thompson, chairman of the highway committee of the Chamber of Commerce, Bakersfield.

The new highway was built by Griffith Company for \$461,075.09. Don Evans was resident engineer for the Division of Highways.

Bureau of Public Roads Did Big Job Last Year

Over 15,000 miles of highway were improved during the past fiscal year in the program administered by the Bureau of Public Roads of the U. S. Department of Agriculture, according to the annual report of the bureau. The bureau also supervised the elimination of 711 grade crossings, reconstruction of 144 obsolete grade-crossing structures, and protection of 744 crossings by signs and signals.

The greater portion of the work was done in cooperation with State highway departments and in this way 12,129 miles of highway was improved.

District IX Needs the Sum of \$19,000,000

(Continued from page 6)

Another important interstate route is U. S. 6, entering California through Montgomery Pass and carrying a rapidly increasing traffic from midwestern and eastern states.

This route is of major military importance in that it is the shortest and most feasible highway between the Naval Arsenal located near Hawthorne, Nevada, and southern California ports and in a case of international disturbance would immediately be subjected to a very heavy and high speed traffic.

The remaining routes serve important recreational areas as well as an extensive mining industry and with the recent agricultural rehabilitation of the Owens Valley, a distinct farm to market need.

The region of the High Sierra of Inyo and Mono counties serves as the recreational playground of many people. An estimate compiled from records of the Forest Service and other agencies indicates that the registered and accounted for visitors for recreation alone to this area exceeds 110,000 persons each summer. To this must be added approximately 60,000 visitors to the Death Valley National Monument each winter. With the improvement of the highways, winter snow sports are developing to such an extent that it is reasonable to expect that within a very few years this traffic demand will reach proportions that will tax the ability of the State to finance the maintenance, in a snow free and travelable condition, of the highways of this district constructed to present standards.

Except for a short distance, the lack of railway facilities within the district places the ever increasing burden of heavy hauling directly upon the highways. The overloading of the light type construction results in a rapid deterioration of the surface on the major routes that is reflected in high maintenance expenditures and will eventually, as funds can be provided, justify the increased cost of a higher type of construction.

Comparable with other sections of the State, an unusual condition exists within the district in that, induced by desert alignment between widely separated stopping points,

Farm to Market by Truck

In Volume 22, No. 4, of "The Agricultural Situation", issued by the Bureau of Agricultural Economics of the U. S. Department of Agriculture, William C. Crow says, "Large city markets now receive about half their supply of fresh fruits and vegetables by motor truck. A survey in 1936 revealed that nearly 45 per cent of the supply of 40 large cities was transported by motor—New York City, about 40 per cent; Philadelphia, 45; Boston, 33½. The figures ranged up to 72 per cent for Atlanta and 83 for Los Angeles."

maximum speed is common. In order to build a reasonable degree of safety into the highways it will be necessary to reconstruct many miles to new standards.

The problem of snow removal on 200 miles of highway at elevations between 6000 and 9000 feet calls for a rapidly increasing expenditure of funds in order to keep pace with the traffic demands as expressed in the thought of the traveling public, that, the routes should be comparatively snow and ice free and open to travel at all times without interruption. This problem alone requires an expenditure averaging \$400 per mile per year of maintenance funds for highways located in the snow areas together with other increased expenditures required to repair and restore the light type surfacing damaged by traffic under adverse conditions.

Since the snow removal will continue to be an annual obligation, it is obvious that in order to avoid a much greater expense, a surfacing adequate to meet the demands must be provided.

Considering a period of ten years it is estimated that to put the roads and bridges within the district in condition to serve present traffic and with a reasonable allowance to cover

obsolescence and expansion would require:

170 miles on which additional surfacing and minor widening will be necessary	\$1,700,000
510 miles construction (light type) and reconstruction of older and obsolete roads	13,500,000
90 miles construction (heavy type)	3,400,000
Bridges, drainage dips and flood protection	400,000
Total required	\$19,000,000

The construction expenditures in District IX for the period July 1, 1932, to June 30, 1938, total \$3,069,000, the average expenditure being \$511,500 each year. With past allocations as a basis, it is evident that without an increase in available funds, a period of 38 years will be required to bring the highways of the district to a standard suitable to properly serve present demands.

Neither does this estimate contemplate the additions of mileage of highways to the State System or provide for a change of type or standards to meet the development of traffic service.

This problem is one of increasing importance that can only be satisfactorily met by increased allocation of funds that will permit an improvement of the highway system with sufficient rapidity to overcome deterioration of the present system and for expansion to meet increased usage.

Ed (In Chicago for Live Stock Exposition): "Dull here, isn't it?"

George: "Dull! Why, I almost wish I had brought my wife along."

"Lay down, pup; lay down," ordered the man. "Good doggie—lay down, I say."

"You'll have to say, 'Lie down,' mister," declared a small bystander. "That's a Boston terrier."

The frugal Scot was taking his son for a walk, when he said thoughtfully, "Son, have you got on your Sunday boots?"

"Aye, Father," was the reply."

"Then take longer steps."

Farmer—Gosh! You must be brave to come down in a parachute in a hundred-mile gale like this.

Stranger—I didn't come down in a parachute. I went up with a tent.

California Protects Gas Tax Funds by Constitutional Act

By GEORGE T. McCOY, Assistant State Highway Engineer

BY UNMISTAKABLE mandate of the people of California, gasoline tax funds henceforth will be safe from diversion to other purposes than highway construction and maintenance.

Protection for these moneys was written into the State Constitution by the voters on November 8 when Constitutional Amendment No. 28, requiring that motor vehicle fuel tax funds be used exclusively for public street and highway purposes, was approved by the electorate by the overwhelming vote of 1,505,043 to 766,063.

For many years the motorists of California have zealously guarded their gas tax moneys. At a special election held in 1933 they emphatically voted down two propositions on the ballot proposing to divert gasoline tax moneys. An initiative proposition amending the constitution and designed to prevent diversion was submitted to the voters in 1936 but because of a section requiring that the same tax be imposed upon Diesel motor vehicle fuel as upon gasoline, a confusion of issues involved in the proposition resulted in its defeat.

STRONG ANTIDIVERSION FEELING

Constitutional amendments preventing diversion of motor vehicle revenues to nonhighway purposes were approved by voters in three States at the last general election, namely, California, Michigan, and New Hampshire. A similar proposal failed in Alabama by a narrow margin. The New Hampshire proposal won by a five to one vote and the Michigan amendment was carried by more than 200,000. Indicative of the strong antidiversion feeling in California, Los Angeles County alone voted 670,810 to 296,953 for the new constitutional amendment.

Prior to the last election Kansas, Minnesota, Colorado and Missouri had written into their constitutions amend-

ments against diversion of gasoline tax funds. Maine has banned diversion and Nevada and Indiana legislatures have initiated constitutional amendments on the same subject to be submitted to the people.

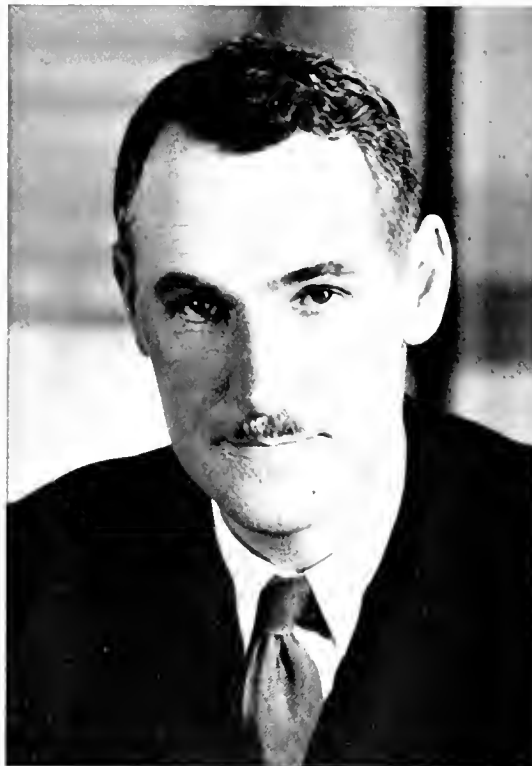
Undoubtedly there is a very definite trend throughout the country against gasoline tax diversion. According to the Bureau of Public Roads, more than one billion dollars

Union and the District of Columbia was collecting a motor license fee with levees for that year totaling eight million dollars. In early stages, motor vehicle fees were not imposed for revenue purposes but were levied merely to provide facilities for the protection of persons and property such as the registration of vehicles and the prevention of theft. For this reason, funds sufficient to cover only expenses and administrative costs were raised.

As early as 1914, however, 41 States were using motor vehicle registration collections for highway purposes; and by the following year practically 90 per cent of the total revenues so derived was applied to road work. A tendency to make small diversions from registration fees became apparent as early as 1916, but as a rule most States followed the original policy of utilizing the funds for the administration of such registrations, policing and the prevention of theft. With the increase of collections, the surplus was generally used for highway construction and maintenance.

OREGON STARTS GAS TAX

Oregon initiated the first gasoline tax in 1919 and was followed by North Dakota, New Mexico, and Colorado. These initial statutes except in North Dakota generally provided that the collections must be used for highway purposes. This practice was rather consistently followed for a number of years. Records indicate that it was the general practice of most States until comparatively recent years to refrain from the application of motor vehicle fees and gasoline taxes to other than highway purposes. During the last seven years, however, diminishing State revenues encouraged legislators to resort to motor vehicle taxes as a fruitful source of funds for all manner of expenditures



GEORGE T. McCOY

have been diverted from highway purposes since diversion became a practice.

FIRST MOTOR VEHICLE TAX

The first law imposing motor vehicle registration fees was enacted in New York State in 1901. Similar legislation followed in Massachusetts in 1903 and in five other States in 1905. By 1913, every State in the

unrelated to constructing highways. The federal government was compelled to register its opposition to diversion of motor vehicle funds and the Hayden-Cartwright Act of 1934 was the result.

Section 12 of the Hayden-Cartwright Act provides that States diverting highway funds shall be penalized not to exceed one-third of the federal aid allotments for highways. Several eastern States have felt the sting of the Hayden-Cartwright Act.

STATES PENALIZED

Diversion in Massachusetts caused the government to withhold \$472,862 of the federal aid apportionment of \$3,171,423 for the fiscal year ending June 30, 1938. Under similar circumstances \$250,000 was deducted from the apportionment to New Jersey for the fiscal year 1937. Maryland, Pennsylvania and Georgia were penalized. There is a strong sentiment in congress for increasing the penalty imposed for diversion to two-thirds of the apportionments or denying federal aid altogether to States that persist in the practice of diverting their own gasoline and other motor vehicle tax revenues to non-highway purposes.

The Hayden-Cartwright Act is an unmistakable warning to legislatures to turn a deaf ear to proposals for diversion. In California, the people have taken the matter into their own hands and now with constitutional safeguards for gasoline taxes, there is no need to fear the imposition of federal penalties even though some future legislatures might be inclined to find a way around the constitution to divert highway funds.

CALIFORNIA'S NEW AMENDMENT

California's new amendment adds an article, numbered 28, to the State Constitution relating to the purposes for which motor vehicle fees and motor vehicle fuel taxes can be expended. The article must be considered in its entirety.

Section 1. This section relates only to motor vehicle fuel taxes now or hereafter imposed. It provides that the revenues from such fuel taxes, over and above the cost of collection and making any refunds authorized by law, shall be used first for highway purposes. It permits, however, the use of not more than the revenue from one-fifth of one cent per gallon tax to be used in aid of special assessments where the dis-

tricts for which the assessments are levied were initiated prior to January 1, 1933.

This latter provision merely continues in effect the provisions of the law in effect at the time the constitutional amendment was adopted.

TAX DISTRIBUTION

The constitutional amendment does not interfere in any way with the power of the legislature to distribute the revenues from motor vehicle fuel taxation to various governmental agencies. The present allocation is that the counties receive the revenue from one cent per gallon gasoline tax while the State receives the revenue from two cents per gallon gasoline tax. From the State's portion, however, the revenue from one-half cent must be spent within city limits. The revenue from one-quarter cent, one-half of this latter amount, must be spent on State highways within cities, while the revenue from the other one-quarter cent may be spent on city streets outside of the State highway system. The constitutional amendment does not in any way limit the power of the legislature to alter this present allocation, that is, the legislature may give the counties more than one cent or restrict them to less than one cent if it so desires, and likewise may change city allocations.

LIMITS USE OF FUND

In 1933, legislation was enacted permitting the use of twenty per cent of the counties' share of the gasoline taxes to be used to aid special assessment districts, and the money in many counties has been so used since that time. The provision in the constitutional amendment merely permits that use to continue but it limits the special assessments to be aided to those in existence on January 1, 1933. If the aid to special assessment districts could be considered a diversion, the diversion occurred by the 1933 legislation and the constitutional amendment prohibits any further use for this purpose. As soon as the bonds for which the special assessments were levied are paid off, there will be no further use of motor vehicle fuel revenue for this purpose.

REGISTRATION FEES

Section 2. This section deals with motor vehicle registration fees and any future taxes that may be levied upon motor vehicles.

This money is first to be used to carry out the powers and duties im-

posed on the Motor Vehicle Department, that is, registration and enforcement. It is also to be available for highway purposes to the same extent as the motor vehicle fuel revenues referred to in section 1.

As is true with respect to the motor vehicle fuel revenues, the power of the legislature to divide this money between the counties and the State is left undisturbed. Under the existing set up, a little over a third of the money is available for the support of the Motor Vehicle Department and the remainder is divided equally between the State and counties.

Ever since 1927 the counties have been authorized to use all or any portion of the funds received from this source to pay off general county bonds which have been issued for highway purposes. For example, Alameda County many years ago pledged its motor vehicle revenues to pay off the bonds issued for the Broadway Low Level Tunnel. The amendment merely permits this to continue, but provides that the money may not be used to pay off any bonds which were issued after January 1, 1935.

LEGAL BORROWING

By the 1933 legislation authorizing the revenue from twenty per cent of one cent per gallon gasoline tax to be used for special assessment relief, the counties were permitted to use all of their motor vehicle fee money for this purpose. The constitutional amendment permits this to continue except that it can not be used for any special assessment relief except where the special assessment district was initiated prior to January 1, 1933.

Section 3. This merely affirms the power of the legislature to provide for the expenditure of the money by the State or by the counties or by the cities of the State. It also permits the temporary loaning to the general fund of the revenues so raised but provides that the loans must be repaid. This is done for the reason that section 444 of the Political Code now authorizes such borrowing and the constitutional amendment merely continues the effectiveness of that section.

REVENUES PROTECTED

Section 4. This is designed to protect all of the existing revenues to the State general fund which might possibly be affected by sections 1 and 2. The whole purpose of the consti-

(Continued on page 24)

Highway Between Redlands and Crystal Springs Realigned

By A. EVERETT SMITH, Assistant Highway Engineer

THE construction of a portion of State Highway on Route 26, between Crystal Springs and Redlands in San Bernardino County was completed on November 1, 1938.

The roadbed was constructed on new alignment, to modern standards, which eliminated numerous sharp, horizontal and vertical curves in the old road that were particularly hazardous to traffic.

On the old road the element of hazard was amplified due to the mixed nature of the traffic which consists of fast passenger cars and nu-

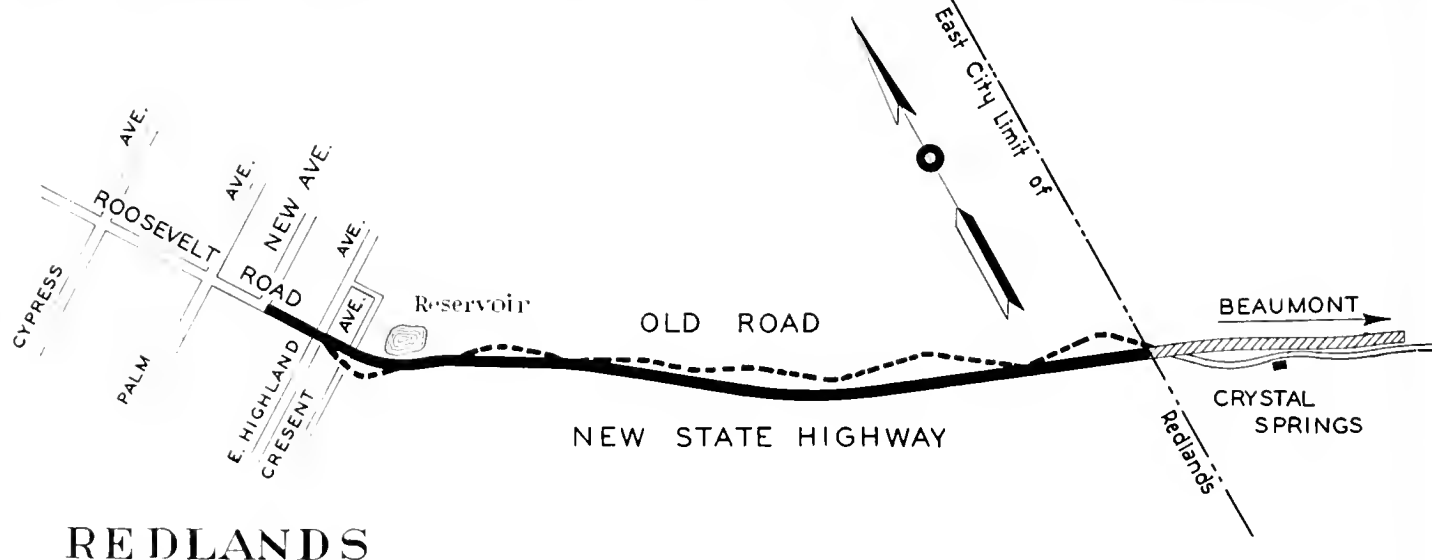
merous trucks ranging up to maximum legal weight and size. This mixed traffic travels at varying rates of speed, due to the limited tangent distance between the sharp curves. The faster cars had little opportunity to pass the heavier vehicles while traveling at slow speeds in a lower gear.

consists of a 22-foot width of Portland cement concrete pavement bordered by wide shoulders, to which a road-mix surface treatment was applied.

In connection with finishing the Portland cement concrete pavement, the new finishing machine was used. Except for the change in finishing procedure due to facilitation of the work by this machine, other phases of construction activity were normal.

To construct the embankment on the westerly one and three-quarters miles of the project, approximately approximately 4400 cubic yards of Class "B" Portland cement concrete was used in building two lanes of pavement, each eleven feet in width and about one and eight-tenths miles in length. The road-mix surface treated shoulders have a minimum width of eight feet on each side of the pavement.

The project beginning at New Avenue extends easterly through Reservoir Canyon and continues on up Crystal Springs Canyon to Crystal Springs. This stretch of highway is the point where the westbound



Sketch map showing realignment of State Highway 26 on the Redlands-Beaumont Route.

merous trucks ranging up to maximum legal weight and size. This mixed traffic travels at varying rates of speed, due to the limited tangent distance between the sharp curves. The faster cars had little opportunity to pass the heavier vehicles while traveling at slow speeds in a lower gear.

TRAFFIC NOT INTERRUPTED

During construction, traffic was carried around the work on the old road and on detours constructed for this purpose.

The newly constructed highway

five million station yards of overhaul were involved. For this work, four-cubic-yard dump trucks were used and were loaded by a two-yard power shovel. The excavated material was taken from the easterly portion of the project in such manner as to form a roadbed to a rough grade section, that may be used as a future alignment correction in the Crystal Springs Canyon.

Adequate drainage was provided for by placing corrugated metal pipes and reinforced concrete box culverts.

From the beginning of the project to the east city limits of Redlands,

traveler leaves the desert roads behind and drives down Crystal Springs Canyon to come upon delightful orange groves, in strange contrast to the arid lands of the desert area through which he has passed.

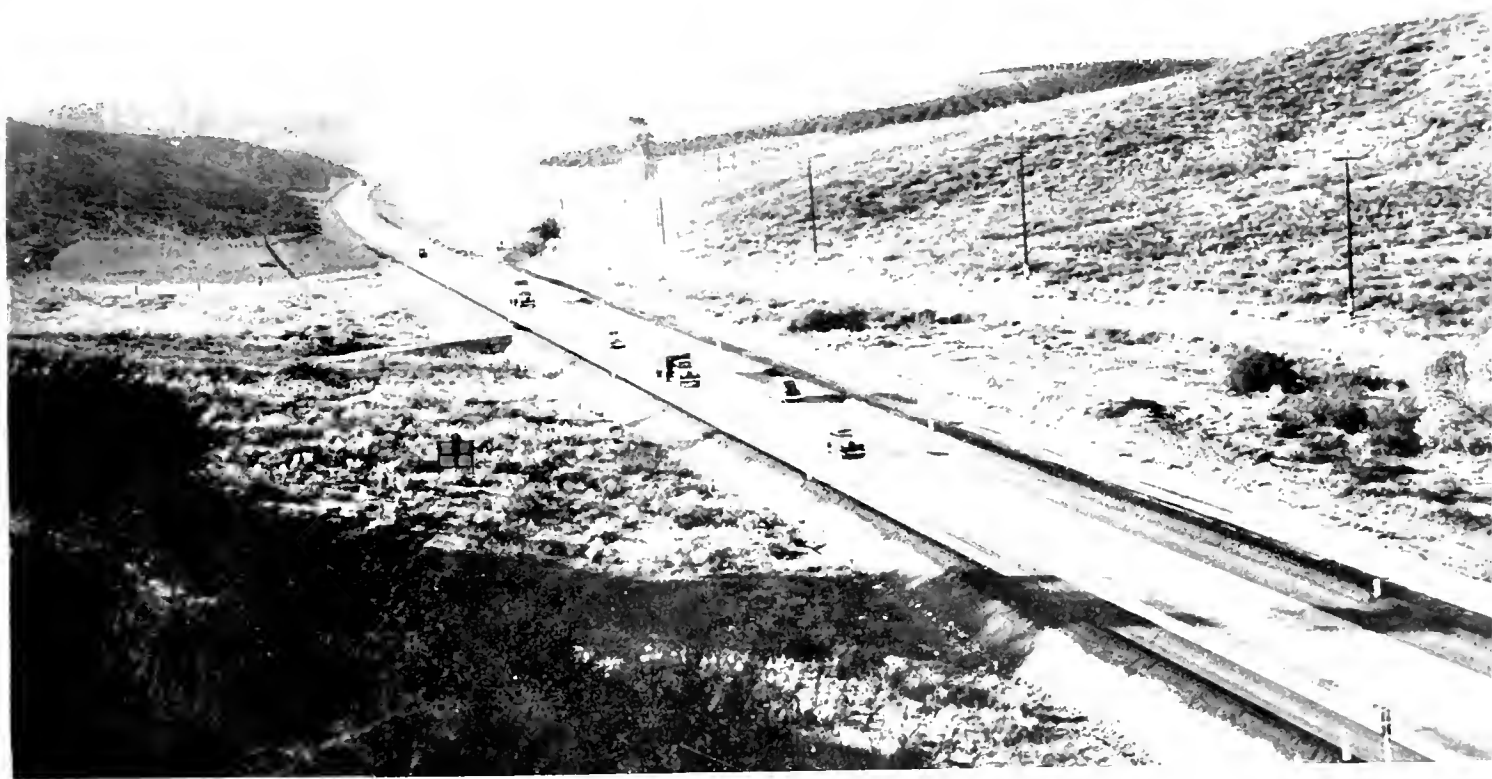
Bids for the project, which is a link in the Los Angeles to Imperial Valley highway were opened on April 21, 1938. The contractor was the Claude Fisher Company, Limited.

Mrs. Black: "Do you know what happens to little boys who tell lies?"

Herbie: "Yes, Mother. They get into the show for ten cents, and travel for half fare."



View of a section of the improved alignment on State Route 26 through Reservoir Canyon where the highway enters the orange grove area at the eastern entrance to the City of Redlands. The realignment eliminates steep and combined vertical and horizontal curves that presented dangerous conditions for traffic on the old highway. Part of the old routing may be seen at left.



Another view of a part of the new State Highway alignment through the valley below Crystal Springs in Reservoir Canyon on the East approach to the City of Redlands. On the old traveled road, seen at the right of the new highway, numerous sharp, horizontal curves made dangerous driving conditions for the heavy traffic that this route carries.



Combined aerial photo and artist's drawing of Bay Bridge and Terminal. Arrow indicates Terminal Building.

Bay Bridge Terminal Officially Opened

AS THIS ISSUE of the magazine goes to press, Governor Culbert L. Olson is scheduled to officially dedicate the San Francisco-Oakland Bay Bridge terminal, initiating train operations on the monumental structure spanning San Francisco Bay.

One of the most imposing buildings in San Francisco, the Bridge Railway terminal is on Mission street between First and Fremont. Faced with California granite, it is of reinforced concrete construction, modern in line and so designed as to reduce walking to a minimum. The distance from track level to mezzanine (street-car level) is approximately 10 feet; from mezzanine to ground floor another 10 feet, making a total distance of 20 feet from track to street. Street-cars rise from ground level to mezza-

nine on a ramp which provides for three tracks.

There is a total of 14 stairs and 11 ramps within the structure, allowing for a wide distribution of passengers, within, while 15 street entrances and exits into and from the terminal tend to eliminate congestion without. These give access to Beale, Fremont, First, Mission, Natoma, and Minna near Second street.

Approximately 60,000 persons, it is conservatively estimated, will pass through the Terminal daily.

Due to the convenience of the Terminal location, 50 per cent of these will be within walking distance of their destinations. This is comparable to 25 per cent now within walking distance from the Ferry Building terminus.

Installation of all signal equipment has been completed. Interurban Elec-

tric trains (S. P.) have completed schooling their engineers on nightly runs across the bridge from the easterly end to the Center Anchorage in the West Bay crossing.

Inspection buildings in the East Bay yard are well under way, with major steel work completed, except for the Key System structure.

The Bridge Railway's own telephone system is installed. The system will involve in all 41 telephones, including phones at five crossovers on the bridge proper, the three substations, and four tie stations.

The Bridge Railway was constructed by the State Department of Public Works under the direction of Chief Engineer C. H. Purcell.

An illustrated article showing interior views of the capacious new terminal building will appear in a later issue of this magazine together with details of the dedication ceremonies.

Many Roads in District I Inadequate

(Continued from page 5)

ble to the entire northwestern portion of the State and, secondly, its development is of major importance to the State as a whole in that it is an important interstate road that has no rival in scenic attraction and is the magnet that draws many thousands of tourists to California each season to view the magnificent groves of Sequoias through which it is constructed. Likewise, it is enjoyed by many State residents living outside the limits of the Redwood Empire during their vacation periods.

Before the addition of approximately 6600 miles to the State Highway System in 1933 the reconstruction of this highway to an adequate standard was planned to be an accomplished fact within a reasonable period.

Secondary State highways within the district make up most of Lake County's road system. In Mendocino County State Highway Routes 56 and 48 are all important to a 100-mile coastal section. While in the northern area, State Routes 35, 20, 46 and 84 make up three laterals connecting U. S. 101 with U. S. 99 and serve a sparsely settled area of considerable size.

In the following estimates of cost to bring these secondary roads to an adequate standard consideration was given both to the rugged nature of the terrain traversed and their relative importance to the State Highway System, neither of which justified their being constructed to the standards that would be considered adequate in more populous and less rugged portions of the State. But regardless of alignment, all State highways should be constructed with passable widths and should have adequate surfacing, and most of all should have structures capable of supporting legal loadings.

At this time there are 53 posted bridges in the district, 44 of them being on secondary highways. The cost of their replacement with adequate structures would require immediate expenditures of \$5,055,000. In all there are 931 miles of State highways in District I, 365 miles being primary and 566 miles secondary, with a further classification as to type of surfacing as follows:

"Safe Travel on the Highways is a Joint Enterprise"

Have roadbuilders and traffic engineers tended to overstress the possibility of accident reduction through the construction and reconstruction of roads to modern standards of design? We frequently read that the application of all the engineering and traffic knowledge we possess to the redesign of our highway system would eliminate an astonishingly large percentage of highway accidents. Should we not reflect that an equally astonishing result might be obtained if all drivers could be made to apply the common sense now exhibited by, let us say, upwards of 90 per cent of those using the highways?

Pursuit of the praiseworthy ideal of building the best and safest highways possible should not lead to the transfer to the highway engineer of the entire responsibility, or an overwhelmingly large share of it, for the safe conduct of traffic over the roads. The obligation is a joint one. For his part, the engineer is forced to think constantly of the cost of modern highway improvements. He must place warnings where he can not rebuild.

The driver's sense of responsibility must keep up with the engineer's. J. W. Vickrey, safety engineer of the California Division of Highways, recently put it this way:

"The engineer will make frank recognition of his responsibility to so design, construct and maintain the highways that they will to the most reasonable degree require and induce safe action on the part of the driver.

"The driver at the same time must never be permitted to forget that the first and main responsibility lies with him. So long as he demands the right to drive a machine that will respond to his control, no amount of engineering on the part of someone else will ever provide him a guarantee of safety."—Editorial in *Better Roads Magazine*.

	Unimproved and oiled earth roads Mi.	%	Oiled earth inferior as to grade, width, alignment, and drainage Mi.	%	Graveled roads with light oil surfaces Mi.	%
Primary	154.67	27.3	118.98	21.0	157.80	43.26
Secondary	216.08	16.6	118.98	12.8	216.08	38.2
Total	154.67	16.6	118.98	12.8	373.88	40.1

	Intermediate types of surfacing Mi.	%	High type pavement in poor condition Mi.	%	High type pavement in good condition Mi.	%
Primary	159.77	43.8	15.38	4.22	26.28	7.2
Secondary	61.75	10.9	1.55	0.3	7.05	1.2
Total	221.52	23.8	16.93	1.8	33.33	3.6

	Bridges Mi.	%	Miles
Primary	5.53	1.52	364.76
Secondary	6.29	1.1	566.37
Total	11.82	1.3	931.13

For the reason that the relative importance of the primary highway system within the district would dictate that its needs be given first consideration in the matter of reconstruction to adequate standards, the estimated cost of reconstruction of the two systems are separated in the following tabulation:

	Mi. of rd. now adequate but will require reconstruction within 20 year period	Mi. of rd. adequate for future
Primary	192.09	13.02
Secondary	128.17	11.10
Total	320.26	24.12
% in miles	34.5	2.5

	Est. cost to reconstruct inadequate roads including r/w	Est. cost to reconstruct roads now adequate but inadequate for traffic in 20 year period (mostly surfacing)	Total est. cost to reconstruct for 20 year period
Primary	\$14,903,000	\$7,555,000	\$22,458,000
Secondary	15,667,000	2,014,000	17,681,000
Total	\$30,570,000	\$9,569,000	\$40,139,000

Sixteen States Share Work on Central Valley Project

With heavy construction just beginning, one-third of the States of the United States are represented in construction contracts awarded to date on the Central Valley Project.

Thirty contracting firms from sixteen states have shared the work so far started or already completed, it is announced by Walker R. Young, Supervising Engineer for the United States Bureau of Reclamation. Several additional States are represented in separate contracts for materials and supplies required for the construction.

Tourist: "How's business here-about?"

Native: "It's so quiet you can hear the notes at the bank a block away drawing interest."

STATE TESTS ROAD DELINEATION BY NEW REFLECTORIZED UNITS

By F. M. CARTER, Assistant Maintenance Engineer

THE Division of Highways is testing reflector units along both sides of State Highway 68, U. S. 101 Bypass, Bay Shore Highway from the South San Francisco subway to Broadway, Burlingame.

Each reflector unit consists of three discs 1½ inches in diameter, placed one above the other in a vertical position in an enameled frame 7¼ inches high and 2½ inches wide. These units are placed on both sides of the standard sight posts on both sides of the highway at a height of approximately 40 inches above the pavement. The sight posts are placed 100 feet apart on tangents, 50 feet apart on curves, and 10 feet from the edge of the pavement.

This section of State Highway was selected for the test because the sight posts were already in place. The original reflector discs as placed on the Bay Shore are made of "Lucite" a synthetic resin. The first installation of such units was made on state highways in Michigan. Approximately sixty-five miles of the main highway between Detroit and Lansing was outlined by this reflector system. Since this Michigan installation several manufacturers have developed reflecting units for the same purpose.

AID TO DRIVER

The reflector unit system is actuated by the headlight of the approaching vehicle and is designed primarily to indicate to the driver the alignment of the highway and especially designate the far edge of the area available to him. The purpose of such designation is to encourage the motorist to drive nearer the right-hand edge of his lane and farther from the center line or the right line of the lane adjacent to the center of the traveled way on a four-lane highway.

In perhaps a somewhat lesser degree of return indication, the Division of Highways has for many years used white painted sight posts to delineate the edge of available roadway along embankments, around curves and at

the approach to bridges and similar locations where the roadway narrows. These sight posts have proved very beneficial to the motorist.

NEW REFLECTORS

A similar assembly of three three-inch red reflecting elements has been standard for several years as clearance markers at points where the roadway is restricted by culverts, trees, or bridges. Where such red clearance units are used, traffic always passes to the left of the marker.

The test installation on the Bay Shore, however, increases the return indication, and with reflecting units positioned on each side of the posts on both sides of the highway, they advise as to the width of the traversable area given to the motorist.

By the aid of the return reflection from these units, the sight of the

driver is not held to the lane line on his left and the glare of approaching headlights is lessened. The momentary darkness caused when an approaching car passes is minimized by the knowledge obtained, through these reflector units, of location within the lane of the nearness to the outside edge of the traveled way.

ADVANTAGES OF SYSTEM

The systematic installation of the reflector units over a stretch of highway is planned so that should any unit be invisible to the driver, notification is given that some object occupies the location at which the reflector unit is obscured.

The proponents of the system of reflector units make many claims for their advantages and use. Some of these are:

- (a) To effectively outline or delineate the highway.
- (b) Afford visual indication of pedestrians or parked vehicles.
- (c) Indicates changes in direction of the roadway ahead such as at turns and over vertical curves. These are disclosed and the nature and degree unfolds far enough ahead to permit proper timing and compensating actions by the driver.

The installation of this system on the Bay Shore Highway has just been completed and while sufficient time has not elapsed to obtain reactions from the motorists, it is apparent from our tests that the reaction and benefits obtained on this four-lane highway are much less than should be obtained from such a system on a two-lane roadway.

The benefit of return reflection is also reduced somewhat, because of the city lights which are visible to the driver on this section of highway.

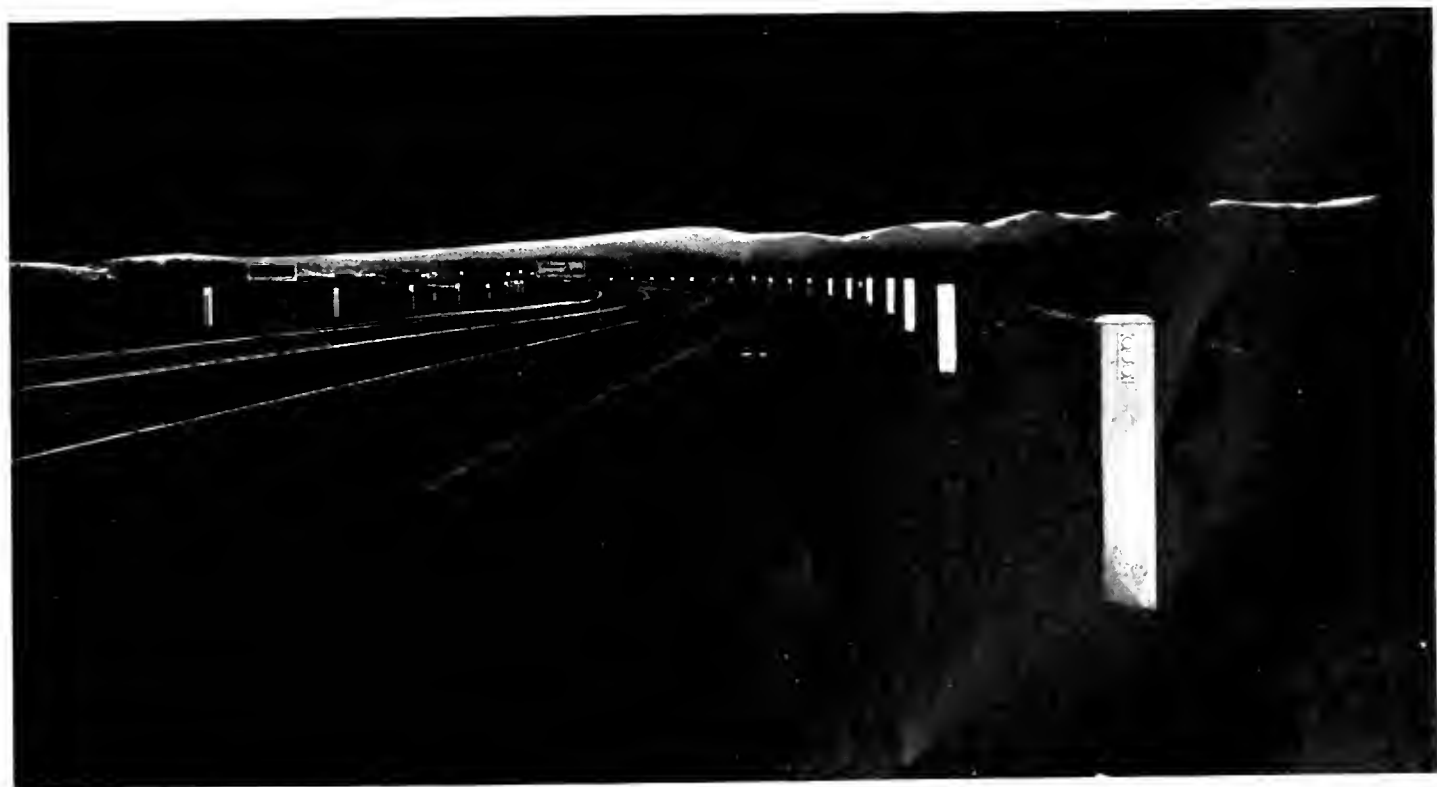
The use of reflector units placed similarly on the outside of sharp curves should prove a distinct benefit to the motorist.



Reflectorized Sight Post now being tested.



View of section of Bay Shore Highway between South San Francisco and Burlingame bordered by reflectorized sight posts being used in an experimental test of night delineation of roadsides. Each post bears three reflector units on two sides that are actuated by headlights of approaching cars.



This view shows how the reflectorized posts outline both edges of the highway at night and plainly give warning of a curve ahead. It is claimed that should any unit be invisible to the driver it gives notification to the driver that a pedestrian or other object occupies the location at which the reflector unit is obscured.

Development of Equipment Shortens Job by Five Months

By EARL E. SORENSON, District Construction Engineer

DUE TO the inventive genius of the contractor on the project in developing new equipment, the widening and modernization of the Rose Canyon gateway to the City of San Diego, a \$380,000 job completed last November, was finished five months ahead of schedule.

More than nine miles of Rose Canyon Highway from Barnett Avenue to Miramar Road, originally improved in 1929 and developed into a three-lane thoroughfare, had to be widened to four lanes to take care of rapidly increasing traffic needs.

In order to assure adequate support for the new pavement on the widened sections placed over old fill areas, it was necessary to recompact the old embankments. This was done by shifting the material and rebuilding the fills in thin lifts with adequate compaction.

Several sections of the old 30-foot pavement through Rose Canyon had settled, due to slippage and inadequate consolidation of the fills. The existing pavement at these locations was removed and water-logged and unsuitable material taken out to an



Drop-hammer operated from truck crane which compacted subgrade to depth 4 to 5 feet.

approximate depth of 2 feet.

In order to compact the fill below this point, considerable experimenting was done with a drop-hammer, operated from a truck crane and it was found that compaction of 88 per

cent could be obtained to a depth of from four to five feet, assuring the necessary support of the new pavement.

LATEST IMPROVEMENTS USED

The asphaltic concrete pavement was placed in conformity to the latest specifications, including the use at the plant, of automatic scales with electrically controlled air valves and pistons for operating the gates on the aggregate bins. On the street the latest improvements in spreading devices and raking machines were employed. A three-axle roller was used with excellent results on the "break-down" immediately behind the raking machine.

Due credit must be given the contractor, D. H. Ryan, for development of new equipment and methods which resulted in better and more economical work. Mr. Ryan is responsible for the developing of an outrigger cutting template placed on a standard bulldozer unit and used to round slopes on the smaller cuts.

The widening job included the resloping of many old cuts which had



"Curry-comb" or spike-tooth slope grader on 75-foot boom attached to shovel.

At top—An outrigger cutting template placed on a standard bulldozer unit used to round slopes on the smaller cuts.

Center—Set of steel forms in sections with interlocking devices and braces which permitted contractor to remove and reset up to 200 feet of double curb per hour on center dividing strip.

At bottom—A traveling asphalt raker.

washed and weathered to an unsightly appearance and which were high enough to present a serious problem. To correct this condition, the contractor developed a method of sloping, using a device similar to a spike tooth harrow, but much heavier, and hauled back and forth on the face of the cut and over the rounded tops by cable, using a shovel equipped with a 75-foot boom. This device was used both with and without guides and with remarkably satisfactory results and surprising economy. The workmen have "dubbed" this device with the very appropriate name of "curry-comb sloper."

DESIGNED CURB FORMS

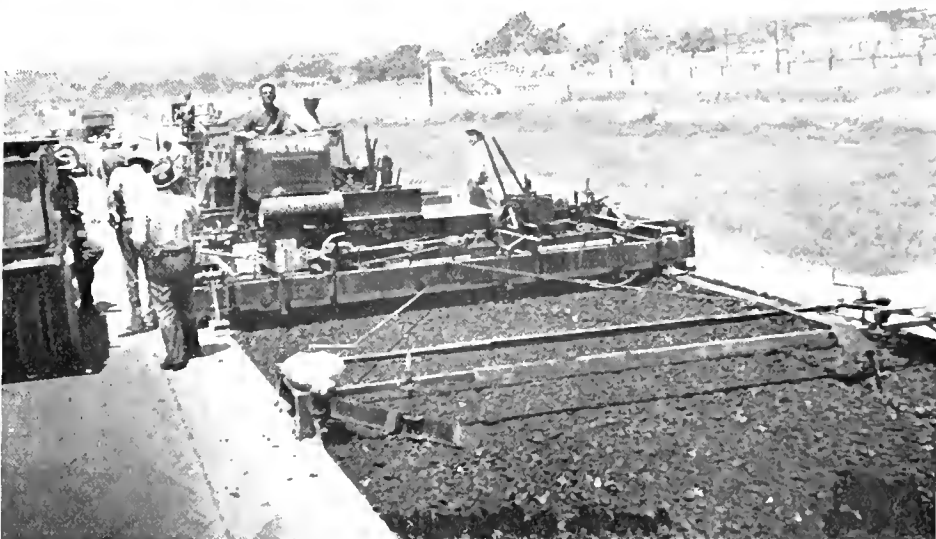
Due to the small amount of concrete per linear foot used in the dividing curbs, which were doweled to the existing pavement, it was necessary to move and reset the curb forms very rapidly in order to avoid any delay to the equipment. To provide for this the contractor designed and constructed a very ingenious set of steel forms, in sections, with interlocking devices and bracing which permitted him to remove and reset up to 200 feet of double curb per hour.

For mixing concrete, a one-cubic-yard traveling paver was used, dragging platforms from which the mixed concrete was shoveled into the forms and also mounting or towing the driving units for both electric and air vibrators.

An RD-8 caterpillar tractor mounting a bulldozer to which was welded a properly shaped cutting template, which rode the side forms, was also developed to cut and shape all widths of subgrade from ten to twenty feet. For speed and economy on hard and difficult subgrade this device was very satisfactory, and appears to have great possibilities.

"Shall we have a friendly game of cards?"

"No, let's play bridge."—*Troy* (N. Y.) *Times*.





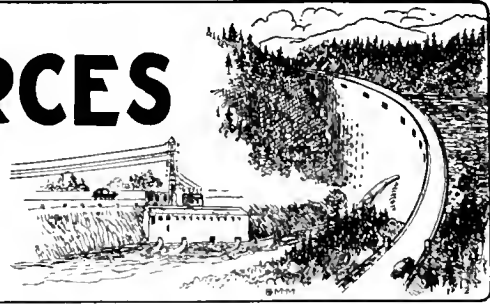
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

December, 1938

EDWARD HYATT, State Engineer



A FEW more applications for allotments from money appropriated to the Emergency Fund by Chapter 11, Statutes of 1938, Extra Session, for the restoration of property, levees, flood control works, county roads and bridges, damaged by the floods of the 1937-38 winter season throughout the State, were received by the Division of Water Resources during the month. Investigations of work requested in these and other applications and the preparation of reports thereon have been continued. More than 240 reports and recommendations have been prepared by the Division of Water Resources and State Reclamation Board and submitted to the Director of Finance, pursuant to his instructions. No further allocations were made by ex-Governor Merriam for flood damage repair work during the month and the allocations for this work to date total \$4,163,200. The Division of Water Resources is performing some of the work for which these allocations were made, and the remainder is being done by the applicants under contracts entered into with the Department of Public Works. There are now 127 such contracts in force covering work which will cost \$3,321,200.

Work was continued on the checking of plans and specifications for all work being done under contracts, and the supervision and inspection of such work by representatives of the Division of Water Resources.

CALIFORNIA COOPERATIVE SNOW SURVEYS

Final details regarding procedure and schedules for this winter's snow surveys have been worked out and arranged for all cooperating agencies. Facilitating details in the field, such as stocking all mountain shelter cabins with food, fuel, bedding, and equipment have been taken care of.

Another new snow course was laid out in the American River watershed, just above

Camp Sacramento on the Placerville-Lake Tahoe highway. Measurements at this new course will be made by rangers of the Eldorado National Forest. With this addition, the number of snow courses to be measured this winter totals 191.

In the upper watershed of the Rubicon River, trail markers have been placed along four miles of trail through difficult country, which will be of material aid to the snow surveyors.

In the office, work has continued on bringing back records up to date. Monthly precipitation records for the period since last July are being tabulated and where runoff records are now available the forecasting curves are being brought up to date. Some research work is also being done with the aim of improving our forecasting procedure.

CENTRAL VALLEY PROJECT

Engineering studies in connection with the Central Valley Project were continued. These studies included analyses of field data previously obtained through comprehensive hydrographic, hydrologic and topographic surveys, for the preparation of a report to be used in connection with negotiations for the acquisition of water rights of the lands bordering the San Joaquin River, which are now being served by that stream. Studies also were continued on matters affecting the disposal of water and power made available by the project, including analyses of present ground water conditions and requirements of certain areas for additional supplies and investigations, and the preparation of reports on districts being formed for the purpose of purchasing water from the project. Negotiations were continued with public utility companies for the relocations of power and communication facilities for the complete project and for temporary relocations necessitated by construction activities. Work was nearly completed on the preparation of a report on the acquisition of, and plan of exchange for, water rights of certain owners along the San Joaquin River proposed to be acquired for the use of the Central Valley Project.

SPECIAL INVESTIGATIONS

Cache Creek Investigations

An engineering investigation was continued for the preparation of a report on a preliminary coordinated plan of flood control for the Clear Lake and Cache Creek drainage areas in Lake and Yolo counties.

Cooperative Flood Control, U. S. Departments of War and Agriculture

The Division of Water Resources has continued studies in cooperation with the U. S. Departments of Agriculture and War for the formulation of a coordinated state-wide plan of flood control for the State of California.

Cooperative Survey by U. S. Departments of War and Interior

A comprehensive survey being conducted jointly by the State of California, U. S. War Department and U. S. Department of the Interior, covering the compilation and analyses of flood data on the record-breaking floods of the 1937-38 season, was continued.

Henshaw Reservoir Yield Study

A study of the safe yield of water for irrigation from the Henshaw Reservoir in San Diego County, made at the request of the Vista Irrigation District with funds furnished by it, was completed and preliminary report prepared.

Conn Valley Reservoir Project

Work was continued during the month by the Division of Water Resources on the preparation of plans and specifications for the construction of the Conn Valley Dam and Reservoir in Napa County. Surveys of the reservoir site and dam and spillway locations were continued by the Division of Water Resources, and surveys for the relocation of the state highway through the reservoir site were continued by the Division of Highways under a service agreement with the Division of Water Resources. An appraisal was made of the lands in the reservoir site by a board appointed for this purpose, and a report was rendered by it to the State Engineer.

IRRIGATION DISTRICTS

Fallbrook Irrigation District was formally dissolved on November 26, 1938, by a decree of the superior court in session at San Diego. The district was organized in 1925 and endeavored without success for a number of years to secure a water supply from Santa Margarita and San Luis Rey rivers. All of the assets of the irrigation district have been acquired by the Fallbrook Public Utility District under which organization the landowners in the area will carry on their efforts to obtain additional water. At an election held December 14, the voters authorized a bond issue of \$150,000 to finance a water development program. A pumping plant and pipe line will be built to supply water from wells on an 80-acre tract

recently acquired in the San Luis Rey Valley.

West Side Irrigation District voted at a recent election to refinance its outstanding bonded indebtedness by entering into a contract with the Reconstruction Finance Corporation for a loan of \$286,500. This will permit the payment of about 50 cents on the dollar to bondholders, 90 per cent of whom have accepted the plan of debt compromise. A petition for confirmation of the plan was filed in the United States district court at Sacramento on December 13, 1938.

SUPERVISION OF DAMS

With the runoff season upon us the repairs on many of the dams in the State are nearing completion.

The Los Angeles County Flood Control District is completing many repairs and alterations to the outlet works on their major structures so that excessive flood-carried debris will not interfere with the efficient operation of their flood control works.

During the month of December, applications were received for the approval of the following dams: Lemoore Diversion Dam, in Kings County; Peconom Dam in Lassen County; Gold Lake Dam in Plumas County. Applications were approved for the construction of Palos Verdes Dam in Los Angeles County and Newton Dam in Napa County. The application for the enlargement of the Bevanda Dam in Calaveras County was approved. Applications for the repair of the Live Oak Dam in Los Angeles County, Roberts Dam in Modoc County and of the McMahon Gulch Dam in San Mateo County were received.

WATER RIGHTS

Receipt and action upon applications to appropriate water during the month of November were as follows: Twenty-one applications were received; 11 applications were denied; 17 applications were approved; 10 permits were revoked, and 15 licenses were issued.

Inspection reports are in process of preparation upon the 228 projects which were inspected during the past field season and an analysis is being made of the 1,316 reports filed by permittees and licensees since October 1.

TOPOGRAPHIC MAPPING

Advance sheets of the Blairsdien and Rogers Lake quadrangles are now available. They are published on a scale of 1:48,000 with contour intervals of 50 feet and 25 feet, respectively. The Blairsdien quadrangle covers an area in Plumas County embracing the NE $\frac{1}{4}$ of what has been known as the Downieville quadrangle. The Rogers Lake quadrangle covers an area in Kern and Los Angeles counties embraced within the NW $\frac{1}{4}$ of what has heretofore been designated as the Kramer quadrangle, a map of which has not as yet been published.

Final maps of the Lakeport quadrangle have recently been published and this sheet is of special interest because the field work was done in part by aerial methods and this

marks the first sheet published under the cooperative agreement with the United States Geological Survey in which topography was thus mapped. This sheet is published on a scale of 1:62,500 with a contour interval of 50 feet.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month the activities have been confined wholly to the routine office work necessary before starting the actual computations of diversions, stream flow and return water in the Sacramento and San Joaquin valleys during the 1938 irrigation season.

The sampling of water in the delta for salinity is being carried on at a number of stations sufficient to record the recession of the salinity.

RELIEF LABOR WORK

The State Relief Administration has abandoned Camp No. 7 at Waybur in Sutter County so that the 100 men formerly employed by the Division are no longer available.

The clearing work in the Feather River overflow channel and the Butte Slough Bypass has continued with an average of 146 men assigned, which is equivalent to the continuous labor of 73 men. At this time the entire crew is clearing in the Butte Slough Bypass.

Under a project sponsored by this Department, there are 98 men assigned, equivalent to 50 men full time, to clearing the channels of Little Chico Creek, Big Chico Creek and Edgar Slough in the vicinity of Chico, and the incidental cost of this work is being paid by Butte County. Plans are now being made to extend this work to Butte Creek, and this office is obtaining the necessary rights of way.

Under the same Department sponsored project, 80 men have been assigned to clearing on the river banks and levees in Reclamation Districts 535 and 673 in Sacramento County. Similar work will be started within the next day or two in Lisbon Reclamation District No. 307 in Yolo County.

At this time there are assigned to work under charge of this Division a total of 324 men from which a continuous working crew of 160 men is available.

EMERGENCY LEVEE REPAIRS

The work of completing the flood damage repairs in Glenn, Butte, Shasta and Tehama counties has been completed and the final report thereon is now in preparation. The last work was on Stony Creek in Glenn County.

Judge: "What's the charge against this man, officer?"

Officer: "Bigotry, yer honor. He's got three wives."

Judge: "I'm surprised at your ignorance, officer. That's trigonometry, not bigotry."

Cornerstone of New State Building in Sacramento is Laid

By W. K. DANIELS, Assistant State
Architect in Charge of Division

LAYING of the cornerstone of the new Professional and Vocational Standards Building at Eleventh and N streets in Sacramento was celebrated by State and county officials on December 29.

The plan of the structure which is being built under supervision of the Department of Public Works is in the form of a block Figure "8" with dimensions of 307 feet by 146 feet. The main entrance is on N street and minor entrances on Tenth and Eleventh. The two light courts are 54 feet by 63 feet and extend through the five stories.

The building is of reinforced concrete construction including its skeleton frame designed to resist lateral force. It will be highly fire and earthquake resistive.

Architecturally and in its equipment and finishes it will conform to the quality set by the neighboring buildings for the Departments of Public Works and Motor Vehicles. An exterior of exposed concrete poured in ply wood forms and finished with cement bonding paint will provide large window openings for these work shops.

In all working areas acoustical plaster ceilings will aid sound control; modern artificial illumination and Venetian blinds will furnish lighting control, and air conditioning is designed to control both temperature and humidity throughout the year.

The gross area is 242,136 square feet including a full basement.

The new building will be occupied by the Board of Equalization, Veterans' Welfare Board, Department of Professional and Vocational Standards, Franchise Tax Department, Division of Lands and Division of Real Estate.

A small assembly room on the first floor will seat 108 in fixed seats. An area 35 feet by 70 feet on the sixth floor will seat 350 in seats not fixed or accommodate approximately 120 seated as for an examination.

Three and one-half inches of insulation will be provided in the fifth floor ceiling under the roof and a

(Continued on page 28)

California Protects Gas Tax Funds by Constitutional Act

(Continued from page 13)

tutional amendment was to provide that the existing revenues which were devoted to highway purposes would continue to be so devoted and that any new motor vehicle fuel or motor vehicle taxes levied would be used for such purposes. As to existing taxes which were not used for such purposes, the purpose of the amendment was to permit the continuance of the present uses of the money raised by them.

Section 4 first provides that the constitutional amendment shall not apply to the taxes raised by Chapter 339, Statutes of 1933. This chapter is commonly known as the three per cent truck tax act. A tax of three per cent of the gross receipts is imposed upon all operators of motor vehicles for hire except where they operate entirely within a city. The revenue from this act since its enactment in 1933 has gone into the general fund of the State. This constitutional amendment will permit the continuance of such payment into the general fund.

BOND PAYMENTS

There has been some confusion as to an amendment made to this act in 1935. The 1933 act as enacted provided that of the revenue paid into the general fund of the State there should be set apart a sufficient amount to pay off the various State highway bonds that had been issued. This "ear marking" of the revenue really meant nothing because the State highway bonds were obligations of the general fund anyway, and it made no difference what actual revenue that went into the general fund was used to pay off these bonds. The purpose of the provision in the 1933 act was to prevent agitation to pay these bonds out of the State highway fund as there was considerable sentiment in favor of doing that at that time.

In 1935 the "ear marking" was taken out of the three per cent truck tax act and the revenues were paid directly into the general fund. The reason this was done was that the so-called "in lieu tax," Chapter 362, Statutes of 1935, was enacted and the revenue from that act was payable into the general fund. That act included an "ear marking" for State

Trend Against Gas Tax Diversion Steadily Growing

Three States—California, Michigan and New Hampshire—adopted constitutional amendments at the last general elections prohibiting diversion of gasoline tax funds and motor vehicle revenues to nonhighway purposes.

The California proposal carried by a two to one vote. The Michigan amendment succeeded by a majority of approximately 200,000 votes. The vote in New Hampshire was five to one against diversion.

Colorado, Kansas, Minnesota and Missouri had previously adopted anti-diversion amendments.

According to the U. S. Bureau of Public Roads, more than one billion dollars have been diverted from highway construction since diversion became a practice in many States.

The trend against diversion of gasoline tax funds is widespread and other States are expected to follow the lead of the seven which already have adopted constitutional amendments prohibiting misuse of highway moneys.

highway bonds, but the revenues from the act far exceeded the costs of the principal and interest on the State highway bonds so there was no purpose in having the three per cent truck tax revenue also "ear marked" for the highway bonds.

IN LIEU TAX

The so-called "in lieu tax," Chapter 362, Statutes of 1935, provides for the return of certain percentages of the net revenue to the various counties and cities of the State while the remainder is paid into the State general fund. Some authorities on taxation have shown an inclination to regard this tax as a diversion of highway funds. This would seem entirely

unwarranted under the circumstances. Prior to the adoption of the "in lieu tax" in 1935, all motor vehicles were subject to the general personal property taxes levied on an ad valorem basis by counties and cities. The revenue from the general property taxes, of course, went into the general funds of the counties and cities and was not at all devoted to highway purposes. Although the State did not levy an ad valorem tax, it was authorized to do so prior to 1935 if necessary to provide sufficient State revenue. Had it done so, motor vehicles would have been included along with all other personal property and the revenue would have been paid into the State general fund.

COUNTIES PAID BACK

When the "in lieu tax" was adopted, local governmental agencies were thereafter prohibited from levying personal property taxes on motor vehicles. The act itself provides for paying back to the counties and cities a certain share of the receipts of the "in lieu tax." It has been said that the local governmental agencies receive almost as much revenue now as they did previously due to the fact that no motor vehicles are able to escape taxation as they were previously, and due to the fact of decreased cost of collection. The net result is that the State has become the collecting agent only for the personal property taxes on motor vehicles. In no sense can it be considered a new tax nor can it be said to constitute a diversion.

Section 4 also specifically provides that taxes collected under the sales tax or use tax are not affected and that these may continue to go into the general fund. This was done because of the fear of some people that sales taxes imposed on the sale of an automobile would be covered by the constitutional amendment. This was not the intention and is clearly so stated in section 4.

Section 4 also provides that the Unemployment Relief Bond Act of 1933 shall not be affected.

The Unemployment Relief Bond Act of 1933 provided for the sale of twenty million dollars of State bonds

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Italy Interested

Instituto Sperimentale Stradale
Della Consociazione Turistica Italiana
E Del Reale Automobile Club D'Italia

Milano, 19 November, 1938.

Spett. le Rivista,
California Highways and Public Works,
P. O. Box 1499,
Sacramento, California.

We propose to institute a systematic exchange between your California Highways and Public Works, which is always at our disposal for interesting reference, and our review "The Highways," the organ of our institute, and which we will send you complimentary.

Would you be willing to consider exchange with our publication, the oldest Italian publication specializing in all technical, experimental, legislative, economic and administrative problems regarding the highways?

We trust and anticipate your approval of the exchange of reviews. We send you our regards.

Il Direttore,

CESARE BIFFI.

College Student Aided

Associated General Contractors of America
Southern California Chapter
801 Washington Building
Los Angeles, California

December 30, 1938.

Mr. John W. Howe, Editor,
California Highways and Public Works,
Sacramento, California.

Dear Mr. Howe:

I have a nephew who is graduating as a civil engineer in June and who is specializing in highway engineering and last evening while visiting at my home he had an opportunity to look through my file of "California Highways and Public Works" which interested him very much.

He expressed the opinion that a careful study of your magazine would probably be just as useful as some of the courses which he is taking in college so at his request I wish to ask if it is possible for you to put his name on your mailing list to receive the magazine monthly for a little while at least.

I don't like to impose upon your good nature, but I am also anxious to secure a complete file of your 1938 issues and

if it is possible for you to send me one copy of each monthly issued during 1938 I will be very grateful to you.

In closing I want to say that I read your magazine with more interest than any of the publications which come to my office and I want to congratulate you on the fine standards which you have maintained.

Best wishes for a Happy and Prosperous 1939, I remain

Sincerely yours,

(Signed) F. J. CONNOLLY,
Manager.

Praise From Oakland

5714 Broadway,
Oakland, California.

December 26, 1938.

California Highways and Public Works,
P. O. Box 1499,
Sacramento, California.

Gentlemen:

I have read several issues of your "California Highways and Public Works" magazine and would like very much to be placed on your mailing list to receive it regularly.

The articles interest me in that they show the trends and latest developments in highway and street work all over California. This, I think, may, in a way, help me in my work as construction superintendent in the City of Oakland street department.

Very truly yours,

(Signed) W. H. TAMM.

An Appreciation

Hollywood, California.

December 5, 1938.

Mr. S. W. Lowden,
Division of Highways,
Bishop, California.

Dear Mr. Lowden:

About a week ago, traveling from Death Valley to Hollywood, my car broke down at about the end of what, I believe, is your division. I had the good fortune to stop behind a State truck manned by M. M. Warner and Sam Gordon. Despite the fact that they were at the end of their run and in a hurry, they plugged the leaks in my radiator and towed me to the top of a hill where I could get a run down into a service station. As it turned out, they saved me hours of delay

and a great deal of discomfort—and a lot of mental anguish.

I tried to get them to accept something for their kindness, but they refused; and I literally had to pry their names and yours out of them.

The purpose of this letter is to express my gratitude in what is apparently the only way I can do it. You now have one more loud and enthusiastic booster for the State highway service and one more admirer of the men in it.

Incidentally, if Mr. Warner or Mr. Gordon should be in Hollywood some time and want to see Paramount Studio, I could arrange it. They can call me there. And if you could tell them I really remembered and wrote, I'd appreciate it.

Best wishes to District IX.

Gratefully,

ROBERT CARSON (SS),
8281 Norton, W. Hollywood, Calif.

P. S.—The next time my wife and I pass a State highway truck, we're going to wave to 'em.

Minnesota University Writes

University of Minnesota Library
Minneapolis, Minnesota

Dec. 29, 1938.

We are desirous of securing a copy of the report as listed below, "California Highways and Public Works," if available, free of charge.

If the name of our library is not now on your permanent mailing list, is it possible for us to be included?

Very truly yours,

RAYMOND H. SHOVE,
Head of Order Department.

Aid to City Engineer

City of Fullerton, California
City Hall, 123 West Wilshire Avenue.

November 23, 1938

Editor Highway Bulletin,
Sacramento, Calif.

Dear Sir:

I would appreciate your sending me the Highway Bulletin magazine as I have read same and found it contains many interesting and educational articles.

Yours very truly,

(Signed) H. A. HILTSCHER,
City Engineer.

National System of Parkways and Freeways Coming

DEVELOPMENT of parkways and freeways into a national system is foreseen by the *National Park Service*. Its sixty-page illustrated Year Book makes this statement:

"With the tremendous increase in motor traffic over-crowding the highways, the parkway has offered an avenue of escape free of commercial vehicles and cluttered roadsides. Today, in certain sections of the country, parkways function as important arteries of travel for pleasure vehicles. They provide safe, fast routes through metropolitan districts and between important recreational centers. Tomorrow, parkways and freeways or limited motorways, will form a national system for motor transportation."

The National Park Service expresses the opinion that, "In all levels of planning, national, regional, state, county and city, parkways should be carefully studied because of their direct relation to the problems of transportation, recreation, conservation and natural resources, land use, and zoning." State and regional planning agencies are said to be now emphasizing the importance of parkways.

The difference between a parkway and a highway is explained by the National Resources Committee as follows: "An elongated park with a road running through it, in counter distinction to a highway, possessing a board right-of-way. In the case of the parkway, access is wholly under control of the administrative agency; in the case of the highway, abutting property owners possess definite rights of access."

Another authority defines a free-way, or limited motorway, as a strip of public land devoted to movement over which the abutting property owner has no right of access.

The National Park Service says that, "Except for the Mount Vernon Memorial Parkway, and the national parkway projects, Blue Ridge, Natchez Trace, and Colonial, actual parkway construction has so far been generally limited to metropolitan regions."

Bay Bridge Traffic Report Shows Increase Over December, 1937

A TOTAL OF 8,621,196 vehicles crossed the San Francisco-Oakland Bay Bridge during 1938, it was revealed in a December traffic report filed by State Highway Engineer C. H. Purcell with Director of Public Works Frank W. Clark. This compares with the total of 9,104,765 vehicles for the year 1937. The drop from last year's total was attributed to low-rate automobile ferry competition. However, last month's traffic figures showed an increase over any previous month since the ferries lowered their rates in August, 1937, the report said.

A total of 783,846 vehicles crossed the span during December, averaging 25,285 cars per day, and bringing revenues amounting to \$410,227.41. During the three-day Christmas holidays 102,565 vehicles crossed the Bay Bridge.

December traffic a year ago totaled 721,048 vehicles. A general increase in the various classifications of traffic was indicated in the December 1938 figures over those for the same period of 1937. The number of trucks to cross the bridge in December, 1938, was 40,264 as compared to 25,316 for December, 1937. Truck trailers also increased with 1607 for last month and 954 for December, 1937. Freight pounds for last month numbered 114,999,050 as compared to 59,597,004 for the same period in the previous year.

Total freight pounds for 1938 is 1,076,601,801. Other 1938 totals are: Motorcycles, 28,944; buses, 144,549; trucks, 402,340; truck trailers, 17,162.

Total number of vehicles to cross the bridge since its opening on November 12, 1936, is 19,061,189.

Comparative figures follow:

	Total December	Total November	Total since opening
Auto Trailers -----	683	859	30,463
Passenger Autos -----	709,223	708,587	17,677,209
Motorcycles -----	1,715	22,461	65,249
Tricars -----	1,164	1,210	21,650
Buses -----	13,616	13,239	247,634
Trucks -----	40,264	39,760	720,320
Truck Trailers -----	1,607	1,743	39,579
Toll Vehicles -----	768,272	767,859	18,802,104
Auto Passes -----	14,533	13,767	232,528
Truck Passes -----	1,041	1,626	26,557
Total Vehicles -----	783,846	783,252	19,061,189
Extra Passengers -----	247,439	238,999	4,748,635
Freight Pounds -----	114,999,050	115,921,750	1,822,259,126

Pounding Seas Damage Roads

Considerable damage was done to highways in Mendocino County by high seas of January 5, District Highway Engineer E. R. Green reported to the Central Office in Sacramento.

About 1500 cubic yards of new fill at Seaside Creek were washed out. A pile abutment about 320 feet long at Caspar Creek was undermined by ocean waves, the damage amounting to \$2,000.

A concrete pile on Salmon Creek Bridge and some piling on Big River Bridge were damaged by drift.

Del Norte County also suffered from pounding seas. The highway out of Wilson Creek was damaged considerably. The highway south of Crescent City was covered with water and drift for about three miles and traffic was taken through under control.

In Crescent City, water covered Front street and went as far as Seaside street.

All highways were kept open, Mr. Green reported.

"I started out on the theory that the world had an opening for me."

"And you found it?"

"Well, rather. I'm in the hole now."

Highway Bids and Awards for the Month of December, 1938

FRESNO COUNTY—Across San Joaquin River Overflow, about 8 miles east of Mendota, five bridges to be repaired. District VI, Route 41, Section P. A. Soda and Son, Oakland, \$14,999; A. A. Tieslau, Berkeley, \$12,584; E. G. Perham, Los Angeles, \$14,741. Contract awarded to F. Fredenburg, San Francisco, \$11,684.

KERN COUNTY—Overhead crossing over tracks of A. T. & S. F. Ry. at Oak Street in Bakersfield, consisting of one 88-foot, one 80-foot, one 68-foot, and seventeen 45-foot steel girder spans with reinforced concrete deck supported on concrete bents on treated timber piles and approximately 0.44 mile of roadway to be paved with Portland cement concrete and plant-mixed surfacing. District VI, Route 141, Section Bkd., Union Paving Co., San Francisco, \$183,431; Griffith Co., Los Angeles, \$179,670; Earl W. Heple, San Jose, \$179,505; Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, \$188,268; J. F. Knapp, Oakland, \$189,890; White & Wilberg, Santa Monica, \$189,969; Gibbons & Reed Co., Burbank, \$193,285; Vinson & Pringle, Phoenix, Arizona, \$195,642; Oscar Oberg, Los Angeles, \$197,935; M. B. McGowan, Inc., San Francisco, \$209,528; J. H. Pomeroy & Co., Inc., San Francisco, \$211,016. Contract awarded to United Concrete Pipe Corporation, Los Angeles, \$178,460.70.

LASSEN COUNTY—Between 3 miles south of Standish and Wendel, about 0.6 mile to be graded and surfaced with gravel and penetration oil treatment applied. District II, Feeder road. A. A. Tieslau, Berkeley, \$12,185. Contract awarded to Harms Bros., Sacramento, \$9,929.50.

LOS ANGELES COUNTY—Fremont Avenue, between First Street and Diamond Street, North Street, between Fremont Avenue and North Figueroa Street, and North Figueroa Street, between Diamond Street and Temple Street, a portion of State highway is to be constructed and sanitary sewers to be installed. District VII, Route 165, Section L.A. Griffith Company, Los Angeles, \$18,745. Contract awarded to C. G. Willis & Sons, Inc., and Chas G. Willis, Los Angeles, \$13,363.

LOS ANGELES COUNTY—Between Lomita Boulevard and Wilmington-San Pedro Road, about 1.9 miles to be graded and surfaced with asphalt concrete, Portland cement concrete and plant-mixed surfacing. District VII, Route 165, Section L.A. United Concrete Pipe Corp., Los Angeles, \$86,462; J. E. Haddock, Ltd., Pasadena, \$91,751; L. A. Paving Co., Los Angeles, \$97,778; Oswald Bros., Los Angeles, \$107,923; C. O. Sparks and Muudo Engineering Co., Los Angeles, \$114,826. Contract awarded to Griffith Co., Los Angeles, \$85,584.50.

ORANGE COUNTY—Between Santiago Boulevard and Santa Ana Canyon Road, about 0.7 mile to be graded and paved with Portland cement concrete. District VII, Route 43, Section B. Matich Bros., Elsinore, \$44,912; Griffith Co., Los Angeles, \$46,049; J. E. Haddock, Ltd., Pasadena, \$47,468; Vido Kovacevich, South Gate, \$48,153; C. O. Sparks & Muudo Engineering Co., Los Angeles, \$48,193; V. R. Dennis Construction Co., San Diego, \$49,466; Daley Corp., San Diego, \$51,928; Sully Miller Contracting Co., Long Beach, \$52,918; Claude Fisher Co., Ltd., Los Angeles, \$52,940; C. R. Butterfield & Kennedy Co., San Pedro, \$53,226; Johnston & Perscallo, Los

Three Zones for Development of Highway Landscape

There are certain fundamental requirements in the finished highway product of today that have not always been included, says W. H. Simonson of U. S. Bureau of Roads. The need for conserving topsoil is increasingly recognized. Topsoiling, seeding and sodding are being integrated with regular construction. Native vegetation is favored for roadside plantings. There is increasing interest also in the control of lands adjacent to the highway through the use of building setback lines, regulation of access, grading and seeding easements and so forth.

In highway landscape development, these distinct zones are now recognized: (1) roadbed, (2) roadside and (3) adjacent lands. In planning for tomorrow's highways we must have sufficient right-of-way to provide surfaces to meet the needs of present and future traffic. The roadside must be wide enough to accommodate the ultimate development through reasonable border control, including private lands fronting on highways.

We can not reach the ultimate development in highways with respect to either character of surface or roadside development in the immediate future, because of lack of funds. But the widths of right-of-way obtained now will definitely control the ultimate development. — *Better Roads.*

Angeles, \$55,249; S. Edmundson & Sons, Los Angeles, \$56,593. Contract awarded to United Concrete Pipe Corp., Los Angeles, \$44,300.80.

ORANGE COUNTY—Over A. T. & S. F. R. R., about 0.5 mile north of Galivan, an overhead crossing to be repaired. District VII, Route 2, Section B. R. M. Price,

Huntington Park, \$12,538; Edward Green, Los Angeles, \$12,822; H. H. Peterson, San Diego, \$13,913; The Contracting Engineers Co., Los Angeles, \$13,946; V. R. Dennis Construction Co., San Diego, \$14,445; A. L. Gabrielson, Arlington, \$16,999; J. E. Haddock, Ltd., Pasadena, \$18,549. Contract awarded to Franzini and Fredenburg, San Rafael, \$12,415.50.

ORANGE COUNTY—At Brea Canyon, about 5 miles northeast of Fullerton, reinforced concrete channel protection to be constructed. District VII, Route 19, Section A. Oberg Bros., Los Angeles, \$13,995; R. M. Price, Huntington Park, \$14,405; Edward Green, Los Angeles, \$14,710; Raymond H. Liggett, Lynwood, \$16,340; J. E. Haddock, Ltd., Pasadena, \$16,550; Byerts & Dunn, Los Angeles, \$18,910; Contracting Engineers Co., Los Angeles, \$22,830. Contract awarded to Vido Kovacevich, South Gate, \$13,565.

RIVERSIDE COUNTY—Near Norco, construction of a reinforced concrete girder bridge across Santa Ana River and 0.3 mile of roadway to be graded and surfaced with plant-mixed surfacing. District VIII, Route 193, Section A. White and Wilberg, Santa Monica, \$104,861; C. O. Sparks and Muudo Engineering Co., Los Angeles, \$107,405; Byerts & Dunn, Los Angeles, \$107,312; J. S. Metzger & Son, Los Angeles, \$117,998; John Strona, Pomona, \$119,392; The Contracting Engineers Co., Los Angeles, \$122,666; Oscar Oberg, Los Angeles, \$123,761; R. E. Campbell, Los Angeles, \$125,284; United Concrete Pipe Co., Los Angeles, \$126,186; Baruch Corp., Los Angeles, \$128,203; J. E. Haddock, Ltd., Pasadena, \$135,331. Contract awarded to Vinson and Pringle, Phoenix, Arizona, \$88,154.70.

SAN BERNARDINO COUNTY—About two miles east of Ontario across Cucamonga Wash, a reinforced concrete slab bridge consisting of two 24-foot spans, two 22-foot spans and two 6-foot cantilever spans on concrete piles and approximately 0.13 mile of approaches to be graded and 0.06 mile Portland cement concrete pavement to be constructed. District VIII, Route 26, Section D. H. H. Peterson, San Diego, \$24,947; Oberg Bros., Los Angeles, \$26,569; R. M. Price, Huntington Park, \$27,995; Dimmitt & Taylor, Los Angeles, \$28,167; White and Wilberg, Santa Monica, \$29,445; The Contracting Engineers Company, Los Angeles, \$31,350; Vinson and Pringle, Phoenix, Arizona, \$33,097; Byerts & Dunn, Los Angeles, \$31,825. Contract awarded to Gibbons & Reed Co., Burbank, \$24,714.19.

STANISLAUS COUNTY—About 0.4 mile south of Turlock, a steel beam overhead structure with concrete deck across the tracks of Southern Pacific Railroad, to be constructed and about 0.3 mile to be graded and paved with Portland cement concrete and asphalt concrete. District X, Route 4, Section A. J. F. Knapp, Oakland, \$309,799; United Concrete Pipe Corp., Los Angeles, \$312,890; Earl W. Heple, San Jose, \$295,399; Frederickson and Westbrook, Sacramento, \$297,810; Heafey-Moore Co. & Fredrickson and Watson Construction Co., Oakland, \$295,497; P. J. Walker Co., San Francisco, \$338,985; Eaton and Smith, San Francisco, \$319,455; C. W. Caletti & Co., San Rafael, \$343,905. Contract awarded to Union Paving Co., San Francisco, \$242,044.

TULARE COUNTY—Between Exeter and Venida Substation, about 2.7 miles to

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California Protects Gas Tax Funds by Constitutional Act

(Continued from page 24)

—obligations of the State general fund. The proceeds were to be loaned to the counties for unemployment relief purposes. The act provided that the counties borrowing the money could make arrangements for the repayment of this money in any way they saw fit at the time of borrowing, but that if no such arrangements were made, then the annual installments due from the counties to the State would be deducted from their apportionment of gasoline taxes and would be paid into the general fund. Only one or two counties made any arrangements for the repayment of the money borrowed at the time the borrowing was made, and consequently most of the counties are repaying what they borrowed by having the annual installments deducted from their apportionments of gasoline taxes. The bonds under this act run for only ten years so that by 1943 or 1944 these bonds will be entirely paid off.

The use of the revenue from the in lieu tax, which now goes to the general fund, is also undisturbed by the constitutional amendment except that as long as the tax is imposed enough of the revenue must be "ear marked" to pay off the State highway bonds above referred to.

It is also provided that if the in lieu tax is repealed, the legislature may provide for the payment of the State highway bonds from either the gasoline tax or the motor vehicle fees or any new taxes on motor vehicles that might be imposed—providing such payment out of present highway revenues will not cause the loss of federal funds to the State. There is certain federal legislation now, known as the Hayden-Cartwright Act, which it is believed would cause the loss of federal aid if present revenues were used to pay off these bonds.

The last provision in the amendment attempts to retain the status quo in so far as section 15 of Article XIII of the Constitution is concerned. That section relates to the public school system and for many years has contained a provision which says that the school system shall have the first call on all State revenues. This constitutional amendment states that it does not impliedly repeal that provi-

An Appreciation

The State College
of Washington
Pullman, Washington

College of
Mechanic Arts and Engineering
Department of
Civil Engineering

January 2, 1939

California Highways and
Public Works,
Sacramento, California.

Dear Sirs:

For a good many years I have had the privilege of receiving copies of "California Highways and Public Works" and have found this magazine the most interesting and valuable one of its class; I have also found it very useful in my work of teaching highway engineering at the State College of Washington.

This magazine is especially valuable in its frequent illustrations of modern practice in highway location, design and construction, its demonstrations of research applied to highway engineering, and the frequent demonstrations of the economic value of high cost highway locations. Motorists, as well as highway engineering students, need the facts as to the large values resulting from widening and straightening highways, and the engineers of the highway department are to be congratulated on the convincing manner in which they present these values in the pages of your magazine.

I hope you will be able to continue sending me this magazine, as I would feel lost without its frequent message of good highway engineering.

Very truly yours,

H. E. PHELPS,

Howard E. Phelps, Professor
Highway Engineering.

sion but that if any moneys are used for the support of the schools, they must be returned to the highway funds.

There has always been some doubt as to the effectiveness of the provision in section 15 of Article XIII of the Constitution inasmuch as it provides no method of determining how much money shall be taken from each special fund in the treasury. Due to that fact, it may be entirely ineffective. The effect of this constitutional amendment is to leave whatever uncertainty there is, still existing.

From the above it is apparent that the only reason for the length of the constitutional amendment is that certain diversions or "near-diversions" have occurred in the past and that the amendment attempts to preserve the status quo as to those but to prohibit any additional or future diversions of any kind.

The foregoing article was prepared by Mr. George T. McCoy for the Western Construction News and California Highways and Public Works.

CORNERSTONE OF NEW STATE BUILDING IS LAID

(Continued from page 23)

spray coating of aluminum paint in the roofing will counteract solar radiation.

A garage in the basement will house eighteen State cars.

It is estimated that the building will be completed by October, 1939.

The cost of construction, \$1,500,000, including the land, will be defrayed by rentals paid by State agencies occupying the structure.

The Campbell Construction Company is the contractor.

BIDS AND AWARDS

(Continued from page 27)

be graded and surfaced with plant-mixed surfacing. District VI, Route 129, Section Exr., D. Union Paving Co., San Francisco, \$64,332; Oilfields Trucking Company, Bakersfield, \$62,568; Larsen Bros. and Harms Bros., Sacramento, \$63,818; Pacific States Construction Co., San Francisco, \$67,686; Griffith Company, Los Angeles, \$69,617; Hemstreet and Bell, Marysville, \$70,692; Independent Construction Co., Ltd., Oakland, \$76,108. Contract awarded to Piazza and Huntley, San Jose, \$59,234.15.

STATE OF CALIFORNIA

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets,¹ Sacramento

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FRANK W. CLARK.....Director

EDWARD J. NERON.....Deputy Director

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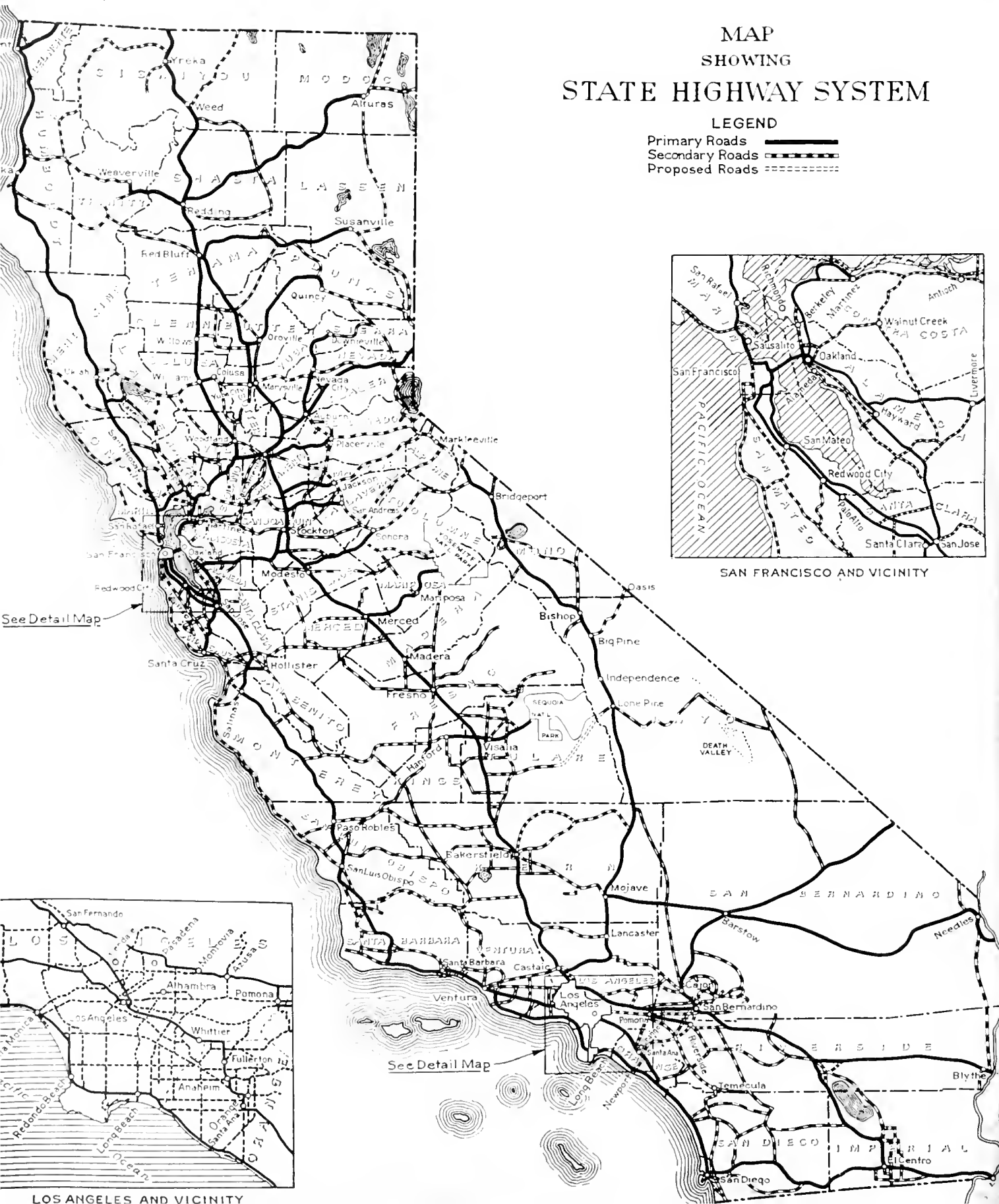
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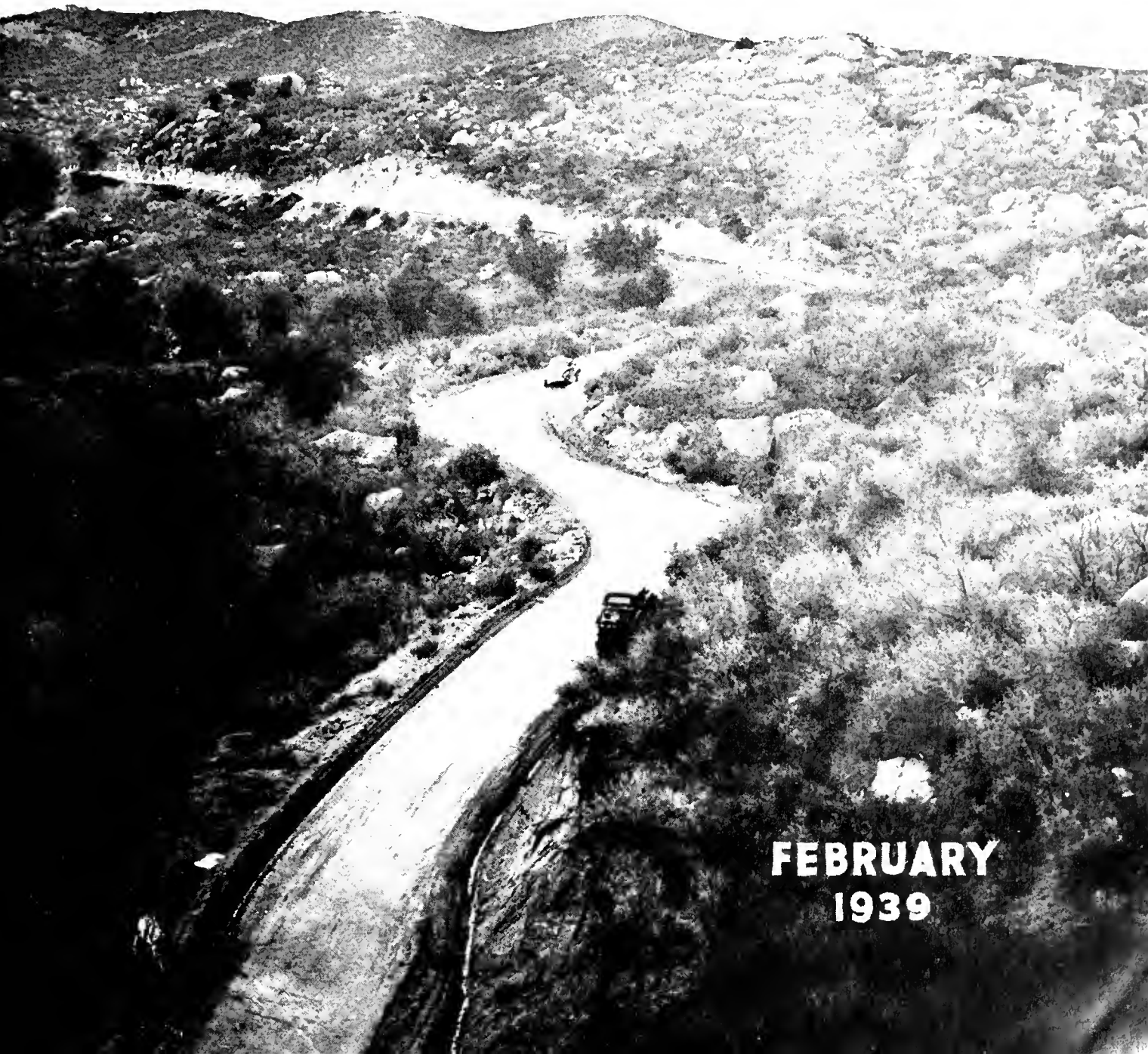
LEGEND

Primary Roads —————
Secondary Roads - - - - -
Proposed Roads =====



CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



FEBRUARY
1939

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

Published for information of the members of the department and the citizens of California

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Vol. 17

FEBRUARY, 1939

No. 2

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\$28,066,102 Total Available Funds for Major Highway Projects During Next 2 Years

RECOMMENDATIONS for allocations to major projects in the biennial State highway budget for the 91st and 92d fiscal years, July 1, 1939, to June 30, 1941, as submitted to Governor Culbert L. Olson by Director of Public Works Frank W. Clark, total \$28,066,102.

This amount will be available for major highway projects constructed throughout the State after statutory deductions are made.

The budget amount of \$28,066,102 is allocated to 200 items or projects of highway improvement as recommended by the Commission after extensive studies and hearings on projects totaling \$144,000,000 for construction costs and urged by individuals and civic groups for inclusion in the budget. These projects would have entailed an additional cost of \$20,000,000 for rights of way expenditures.

\$52,000,000 "MUST" PROJECTS

Recommendations from the eleven district engineers and the Bridge Engineer of the Division of Highways for inclusion in the budget of what were considered "must" projects for the next two years, totaled over \$52,000,000 for construction only, just about twice the funds that will be available for this purpose.

Preparation of the biennial program presented other decided difficulties for several reasons:

Damage to highways and bridges resulting from the storms of the 1937-1938 winter will cost in excess of \$9,500,000 to repair. In order to raise this large sum, it was necessary to borrow from maintenance funds, absorb all betterment and minor improvement funds and even to invade the programmed budget to the extent of over \$2,300,000.

These latter programmed projects were deferred by the Highway Commission with the understanding that they would be replaced as soon as funds became available. This biennial budget program, therefore, includes projects totaling over \$2,300,000 carried over from the current

program for which the commission was obliged to provide.

Another serious situation confronts the State in the allocation of funds. This is the bridge problem. Through the addition to the State highway system of some 6800 miles of county roads, by the Legislature in 1933, the State took over in excess of 1000 bridges, many of which, built in the early days, are of light construction, and inadequate for present-day loads.

BRIDGES REQUIRE \$11,000,000

About 400 of these bridges have been posted for limited loads and speeds because they are structurally inadequate to safely support legal loads. Many have reached the stage where reconstruction is imperative to assure a safe operation of vehicles. They are beyond maintenance operations.

It is estimated that \$11,000,000 is necessary for reconstructing such unsafe bridges within the next few years, and the State is faced with a total expenditure of more than \$30,000,000 to replace ultimately all of these inadequate structures.

Revenues derived from the use fuel tax or the Diesel tax assigned by statute to this purpose, are far from sufficient to reconstruct those bridges which are in immediate need of improvement to prevent accidents. It was, therefore, necessary to make a substantial allocation of State highway funds to such bridge projects.

STATE MUST MATCH FEDERAL AID

A substantial part of the revenues available for State highway construction are provided by Federal Aid appropriations made by Congress. Appropriations for the fiscal years 1940 and 1941, which include regular Federal aid applicable to projects on the Federal aid system, feeder roads, railroad grade separations and Federal lands routes, are considerably less than in previous years. The amount available to California for the next two fiscal years is nearly \$5,000,000 less than in the preceding biennium.

These appropriations are Federal contributions for special and definite purposes to be distributed in accordance with Federal regulations and over which the Federal government will exercise final approval. They are therefore limited in their application but in order to earn this material contribution to State highway construction, allocation of State funds to match such Federal aid is necessary and subject to the limitations imposed by the Federal regulations.

The entire sources of revenue available for the construction, maintenance and operation of State highways to meet the situation set forth above are:

SOURCES OF REVENUE

1—The 3-cent gas tax from which the counties receive 1 cent, incorporated cities, $\frac{1}{2}$ cent, and the State Highway Department $1\frac{1}{2}$ cents.

2—One-half the net revenues of motor vehicle fees after providing for the maintenance of the Motor Vehicle Department and California Highway Patrol.

3—The use fuel tax, or Diesel tax, available only for bridge construction.

4—Regular Federal aid appropriated for the fiscal years 1940 and 1941 by Congress.

The estimated amounts from these sources accruing to the State Highway Department for the two-year period are:

Gas tax	\$64,000,000
Motor vehicle fees....	7,600,000
Use fuel tax.....	600,000
Federal aid	8,000,000
Total.....	\$80,200,000

These estimated revenues for the 91st and 92d fiscal years must cover all activities devoted to the building and operation of State highways, including administration, construction, maintenance, engineering, both pre-

liminary and construction, betterments and minor improvements, joint highway districts, rights of way, contingency reserve, landscaping, maintenance and operation of the San Francisco-Oakland Bay Bridge, and the one-half cent apportioned to cities which the Highway Department is required to pay out of its 2-cent share of the gasoline tax.

LEGISLATIVE RESTRICTIONS

Allocation of these revenues is made in accordance with the various provisions of the legislative enactment requiring distribution to the north and south sections of the State, to primary and secondary highways, to cities, to joint highway districts, and other functions mentioned above.

Administration expenses include the general administrative operation of the headquarters office of the Division of Highways in Sacramento, eleven highway district offices, and the Bridge Department. Additional expenditures made mandatory on the Division of Highways in the support of other departments and functions include the Department of Public Works, the total expense of highway planning — surveys made during the biennium, as well as statutory contributions to the State Controller, Department of Finance, State Treasurer, and Attorney General, which during the present biennium are estimated at \$1,155,000.

\$1 PER MILE AVAILABLE

General maintenance covers the general repair and upkeep of the entire rural highway system for a period of two years. When this figure is reduced to funds available per mile of

road maintained it amounts to slightly over one dollar per day available for each mile.

Under minor improvements, are funds allocated to cover such items of work as short line changes, roadbed widening, additional drainage structures, and other small additions to the existing facilities which, under the law, are not eligible for maintenance expenditures. Very few of the individual allocations for minor improvement exceed \$5,000.

Betterment funds are construction funds handled by the maintenance

come entirely from State highway funds as the Federal Government will not participate in this expense. As many grade crossings are constructed in congested areas, an increase in this expense has been unavoidable. The demand for the establishment of so-called "freeways" in congested areas requires enormous expenditures compared to construction costs. In one instance on a project adjacent to a city in the San Joaquin Valley, far removed from the metropolitan area, right of way costs exceeded the total construction costs involved.

Administration and special study costs for the next biennium are estimated at \$3,600,000. Maintenance of the highways is estimated at \$18,200,000, an increase of nearly \$2,000,000 over the past biennium due to increasing maintenance costs resulting from excessive damage to the highways and to the reduction of Federal aid apportionments. The half-cent to cities is estimated at \$16,000,000. The total of these three items is \$37,800,000, leaving a balance of available funds for the other functions of \$42,400,000.

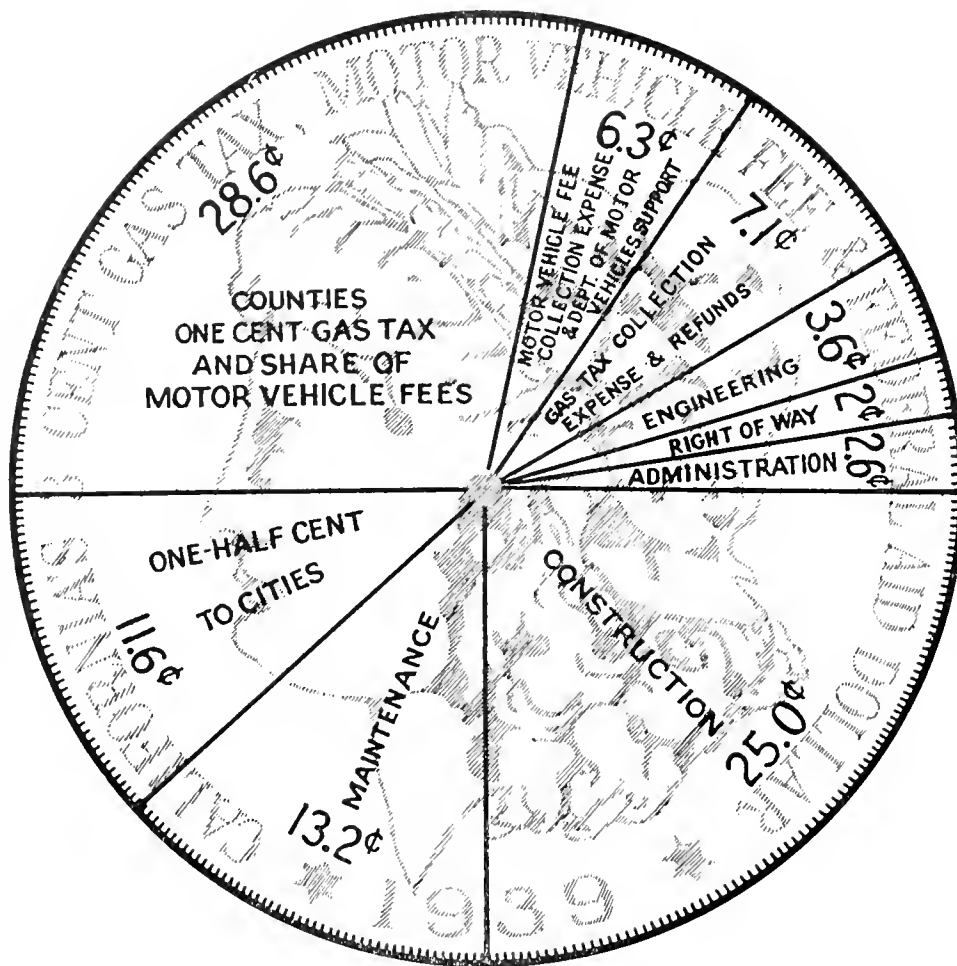
Distribution of this \$42,400,000 for the various purposes provided by statute to the north and

south county groups and to primary and secondary roads shows the final amount available for major construction projects to be \$28,066,102.

From this major construction allocation must come funds to provide necessary work during a two-year period on the 13,900 miles of State highways.

With regular Federal aid apportionments estimated at \$8,100,000 for

(Continued on page 17)



department, and, as in the case of minor improvements, provide for additions to the existing facilities which can not be made with maintenance funds. This money is used for blanketing shattered surfaces, reinforcing weakened bases, widening and oiling shoulders, strengthening weakened bridges, and other miscellaneous types of work.

Right of way expenditures include right of way for grade crossing projects on State highways which must

\$30,286,000 Estimated Cost to Modernize Roads in District XI

By E. E. WALLACE, District Engineer

DISTRICT XI of the State Division of Highways with headquarters in San Diego covers an area of 12,700 square miles, extending over the entire width of the State of California along the southerly sixty miles or more and includes San Diego, Imperial and the easterly portion of Riverside counties.

The State highway system in District XI includes 386 miles of primary highways, 642 miles of secondary highways and 81 miles of city streets, totaling 1,109 miles. The system is improved to the following standards:

Kind	Inferior		Adequate		Total	
	Miles	%	Miles	%	Miles	%
Oiled earth roads-----	215	19.5	66	6.0	281	25.5
Graveled roads with						
light oiled surface----	28	2.5	8	0.8	36	3.3
Intermediate type-----	208	18.9	77	7.0	285	25.9
High type-----	*350	31.8	149	3.5	499	45.3
<hr/>						
Total roads-----	801	72.7	300	27.3	1,101	100.0
Bridges-----					8	
<hr/>						
Total highways and bridges-----	1,109					

Recent developments in southern California have resulted in rapidly changing conditions, with which highway development has not kept pace.

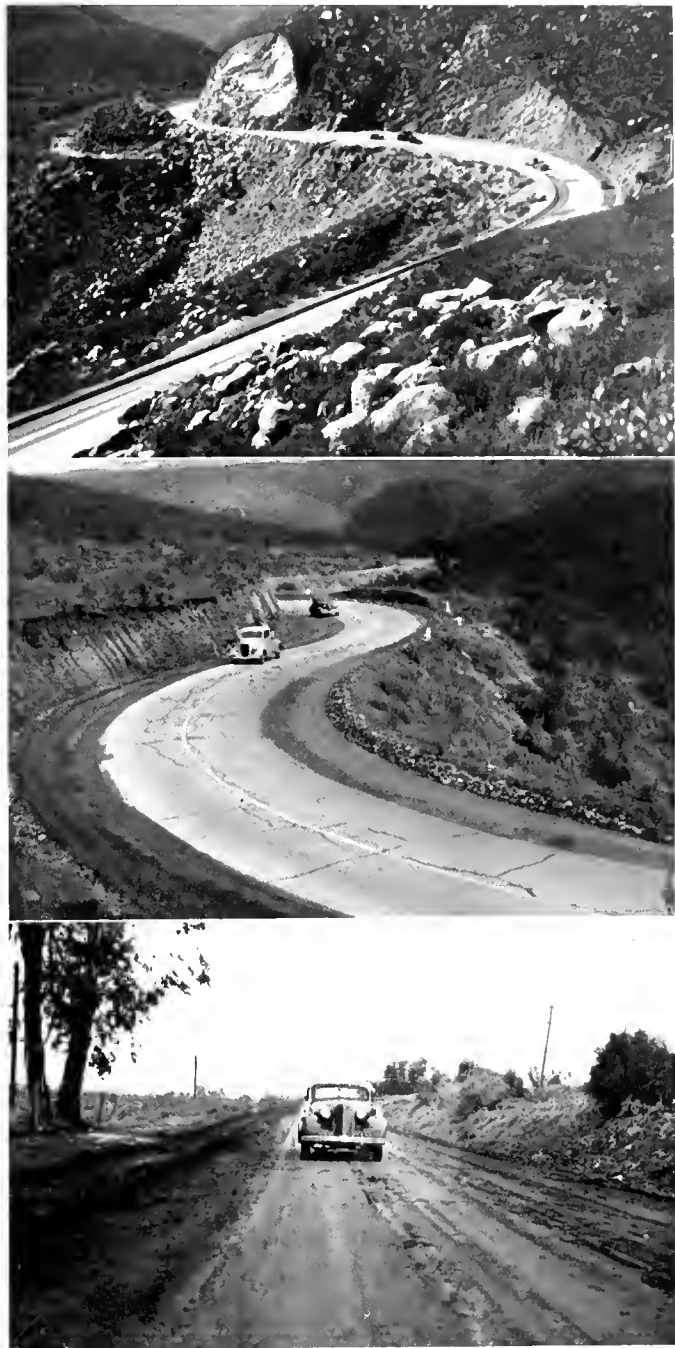
The population in San Diego has doubled in each of the last three Federal censuses and the anticipated population of the San Diego metropolitan area for 1940 is 240,000, as developed by consulting engineers for the water development in San Diego County.

San Diego has many natural advantages in climate, harbor and recreational facilities, including many beaches and mountain resorts, seven State parks, twenty-seven county-owned parks, nine lakes, and the Palomar Observatory. The full use of these areas and the further development of the country are greatly restricted by inadequate or obsolete highways.

Similarly, the development in Imperial and Riverside counties has progressed rapidly since the start was made—about 1910. Before that time the Imperial and Coachella valleys were practically desert wastes, but in 1937 Imperial Valley produced \$43,000,000 worth of important agriculture and animal products, ranking first among all of the counties in vegetable acreage, and third in total State production. Approximately 46 per cent of this production is moved to market by trucks over distances in excess of 100 miles.

The early completion of the All-American Canal will double the irrigable lands and will place additional burdens on the highway system.

* Of the 499 miles of high type surfacing, 350 miles or 70% are obsolete because of poor alignment and grades, and inadequate width.



Top—U. S. 80, San Diego County, narrow, steep grade, sharp curves. Center—U. S. 395, dangerous curves. Bottom—Imperial Valley road lower than fields and roadside irrigation canals.



Top—This picture of a section of State Sign Route 94 in San Diego County shows a narrow road with poor alignment and hazards caused by inadequate slopes. Center—Poor alignment and many blind curves on this stretch of State Route 195 near Oceanside, San Diego County. Bottom—One of many "dips," frequently flooded, on State Sign Route 94. It exists because there are no funds for a bridge



U. S. Highway No. 80, entering the State through Yuma, is one of the main transcontinental highways and is an all-year route over which a large percentage of the foreign traffic enters California.

In 1933, 642 miles of secondary highways were added to the State system within this district, and no additional financing was provided for either maintenance or improvement.

In Imperial County, the additions were practically all of very low standard, unsurfaced and with inadequate bridges. It was impossible to use them after rains, and heavy loss of crops occurred because of the difficulties encountered. At other times the dust was almost as objectionable as the mud.

In view of these conditions and the need for surfacing of the roads, a policy was adopted of obtaining the maximum possible mileage of bituminous treated surfacing with the limited funds available, and within three years all of the newly acquired roads had been oil surfaced, providing surfaced highways which were dustless and mudless. But with this improvement, traffic on these roads has increased rapidly and in some cases over 300 per cent. It is now necessary that the light surfaces be increased in thickness and width and that the roadways be properly graded and drained.

The improvements which have been made to the recently acquired secondary roads have been financed from the 1½ cents State highway gas tax fund and the increase in mileage caused by the addition to the State system has resulted in the necessity for spreading the funds available for construction and improvement over a much greater mileage than was originally contemplated.

The secondary highways in San Diego County are an inheritance from the county bond issues and they were all located and graded prior to 1919. Highways planned for traffic twenty



Top—State Route 78, east of Ramona, San Diego County. Poor alignment and narrow pavement. Center—Route 187 in Riverside County. This is only one of 82 "dips" as they exist today on the North Shore Road. Bottom—Section of U. S. Highway No. 80 in San Diego County. Combination of poor alignment, steep grade, narrow pavement and improper passing, all of which result in high accident record.

years ago and for 30 miles per hour cars are obviously obsolete. At that time the registration of motor vehicles in San Diego County showed 13,622. In 1937, 107,086 vehicles were registered here and San Diego County ranks fourth in motor vehicle registration in the State.

The primary highways are overcrowded and improvements are not keeping pace with the increase in traffic, nor with the rapid development in motor vehicles. The increase in traffic in 1938 on Route 12 between El Centro and San Diego was 9 per cent as compared with a state-wide increase of only 3.3 per cent.

Route 2 is the main coast highway on which improvements have been concentrated during recent years and a good three- and four-lane highway with 14.0 miles of divided roadways has resulted. The road is not yet adequate to handle the rapidly increasing traffic now amounting to 10,000 cars per day.

Floods occasionally block this main artery, after which the only outlet to the north is via U. S. 395, known as the Inland Route, which is a very low standard road, inadequate to handle even the normal traffic.

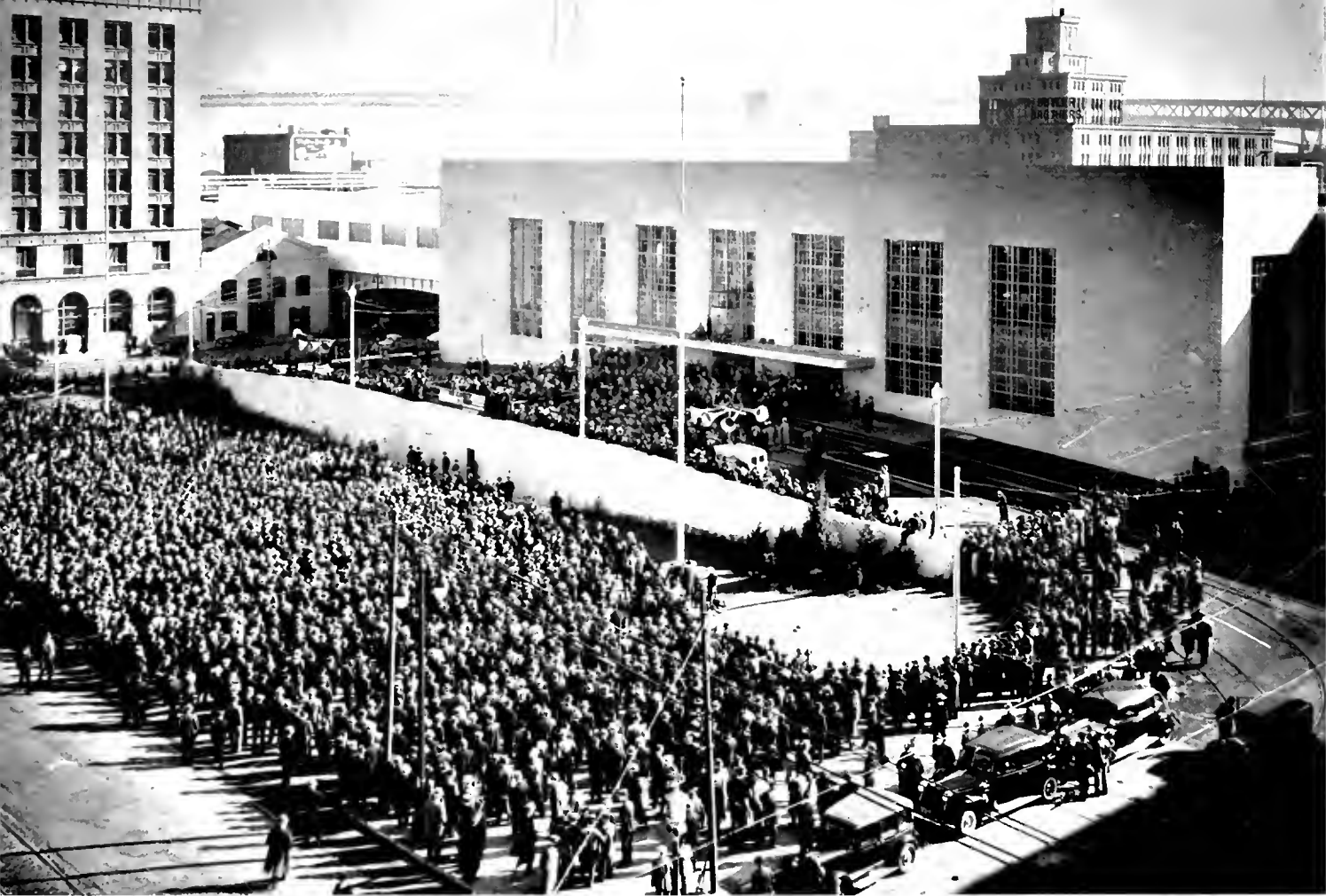
Congestion is occurring on the major highway entrances to the cities, due not only to the increase in highway traffic but also due to the adjacent roadside development which in turn retards traffic and increases the hazards.

Rights of way become increasingly expensive as the adjacent territory builds up. Many of the secondary roads are located on rights of way only forty feet in width, and delays in relocating such highways and securing adequate right of way widths add greatly to the ultimate expense for this item which again reduces the funds which might otherwise be available for construction.

Of the 491 structures in the district, 108 are posted for restricted

(Continued on page 16)





Scene at official opening and dedication of San Francisco-Oakland Bay Bridge Electric Railway Terminal Building in San Francisco.

Bay Bridge Terminal Dedicated

WITH a few formal words uttered at the dedication ceremonies held in San Francisco January 14, Director of Public Works Frank W. Clark turned over to Lieutenant Governor Ellis E. Patterson, representing Governor Culbert L. Olson, the State-owned Bay Bridge and State-built Bay Bridge terminal building and electric railway, the first railway ever to operate directly between Sacramento, Alameda County and San Francisco.

Director Clark said,

"Lieutenant Governor Patterson, I, as State Director of Public Works, declare the San Francisco-Oakland Bay Bridge rail facilities completed for train operation and recommend acceptance by the California Toll Bridge Authority."

Lieutenant Governor Patterson,

representing Governor Olson, who is Chairman of the California Toll Bridge Authority, accepted the completed facilities for the Authority and turned the use of them over to the railroads for operation. Mr. Patterson said.

"On behalf of Governor Culbert L. Olson, Chairman of the California Toll Bridge Authority and member of the Authority, your recommendation is accepted and the California Toll Bridge Authority hereby assumes possession."

To the strains of "The Star Spangled Banner," and "I Love You, California," the National and Bear flags were then raised by the California Highway Patrol.

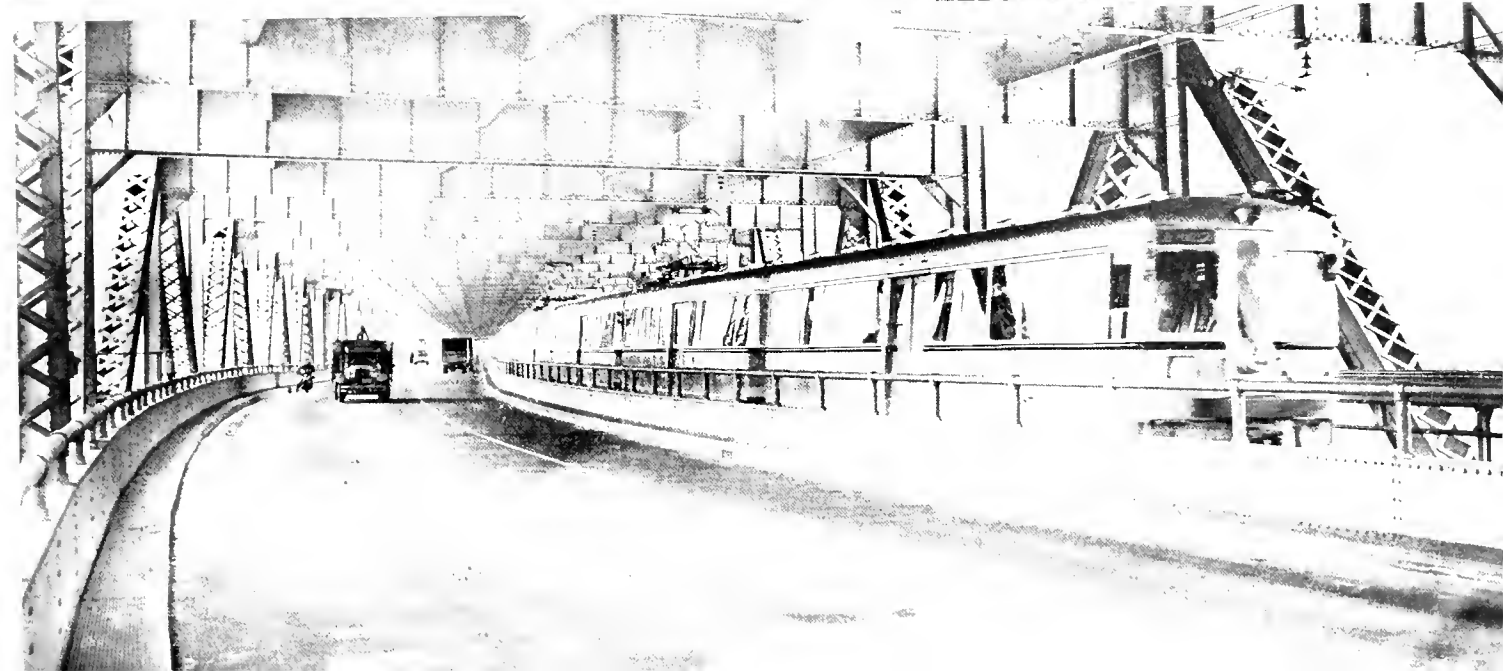
In completion of the formal steps necessary to the occasion Lieutenant Governor Patterson then turned to the

railroad representatives present and said:

"In accordance with the agreement between the California Toll Bridge Authority and Interurban Electric, Key System, and Sacramento-Northern, I formally place the use of these railway facilities in the hands of representatives of the railroads here today. I am certain, gentlemen, that it will be your policy to operate these facilities to the best interest of the public."

A. T. Mercier, president of Interurban Electric; Alfred J. Lundberg,

At Top—One of four passenger platforms on upper terminal level where trains on six tracks load and unload passengers. Center—Mezzanine concourse entered from street car ramp and ground floor waiting rooms. Bottom—Lower Bridge deck carrying train and truck traffic.



president of Key System, and H. A. Mitchell, president of Sacramento-Northern, then formally accepted the use of the facilities for their companies.

The ceremonies were held in front of the newly completed terminal building facing Mission Street in San Francisco with more than 1500 dignitaries from cities of northern California, Alameda and San Francisco counties participating before a great throng of citizens who came to witness the epochal event.

The legal and essential formalities concluded, the program continued with a number of notable speakers.

C. H. Purcell, Chief Engineer of the Bay Bridge and its railway facilities, was introduced by Supervisor John Ratto of San Francisco, chairman of the San Francisco citizen committee for the celebration, acting as chairman of the day. Mr. Purcell was described by Mr. Ratto as "a man who has probably accomplished more for the San Francisco Bay Region as a whole in a shorter period of time than any single person" and "a man who has quietly shouldered tremendous responsibilities and who has executed these responsibilities with great skill and amazing success."

Mr. Purcell said, "Into this project have gone the skill and experience of the engineering profession—civil, electrical and mechanical. Great praise is due the staff of engineers employed by the State Department of Public Works on design and in the field. Also to Bridge Engineer Charles E. Andrew and to Engineer of Design Glenn B. Woodruff, who worked faithfully, conscientiously, and ably, special praise is due."

"Appreciation is also due the fine cooperation given by the American workmen employed on the project; by the contractors engaged in the construction of the facilities and by the railroads who will operate the system."

"To the Federal Government, through the Reconstruction Finance Corporation, and to city and county governments thanks are given for the invaluable aid given us."

Mayor Angelo J. Rossi of San Francisco welcomed the visiting Mayors. Among those who spoke

briefly were Mayor T. B. Monk of Sacramento; Dr. William McCracken, Mayor of Oakland; Edward N. Ament, Mayor of Berkeley; Henry A. Weichart, Mayor of Alameda; Oliver Ellsworth, Mayor of Piedmont; Earl Derry, Mayor of San Leandro.

Florence M. McAuliffe, special counsel for the California Toll Bridge Authority, read a telegram of regret from Jesse F. Jones, chairman of the Reconstruction Finance Corporation. The telegram, addressed to Charles H. Purcell, said:



FRANK W. CLARK
Director of Public Works

"I very much wish I could be present at the dedicatory ceremonies starting interurban service on the San Francisco-Oakland Bay Bridge. Again I am reminded that the design and construction of this bridge is one of the outstanding engineering feats of our generation. It is beautiful as well as being of great service and will stand a credit to all who had part in the great achievement. I extend hearty congratulations to San

Francisco, Oakland and California."

Howard J. Klossner, a director of the Reconstruction Finance Corporation, spoke for the Corporation; and H. R. Judah, chairman of the State Highway Commission and member of the California Toll Bridge Authority, gave a brief but impressive talk.

Frank C. MacDonald, general president of the State Building and Construction Trades Council of California, who was introduced by Director Clark, spoke on behalf of labor.

The 1500 guests had been brought to the ceremonies by Key System and Sacramento-Northern trains. Two six unit Key System trains left 22d and Broadway in Oakland at 10:30 a.m., traveling smoothly over the bridge and arriving at the San Francisco Terminal for the ceremonies at 11:15 o'clock. Labor representatives, contractors' representatives, and civic officials of Alameda and San Francisco counties were present.

A Sacramento-Northern train, originating at Chico, carried mayors and distinguished guests of the Northern California towns along the route. Members of the State Legislature, who had been invited by Governor Olson to attend, were among the guests.

More than 5,000 persons gathered in the plaza before the handsome new Terminal to listen to the ceremonies. After completion of the dedication program the building was opened to the public for inspection. Thousands wandered through the modern structure during the day and evening.

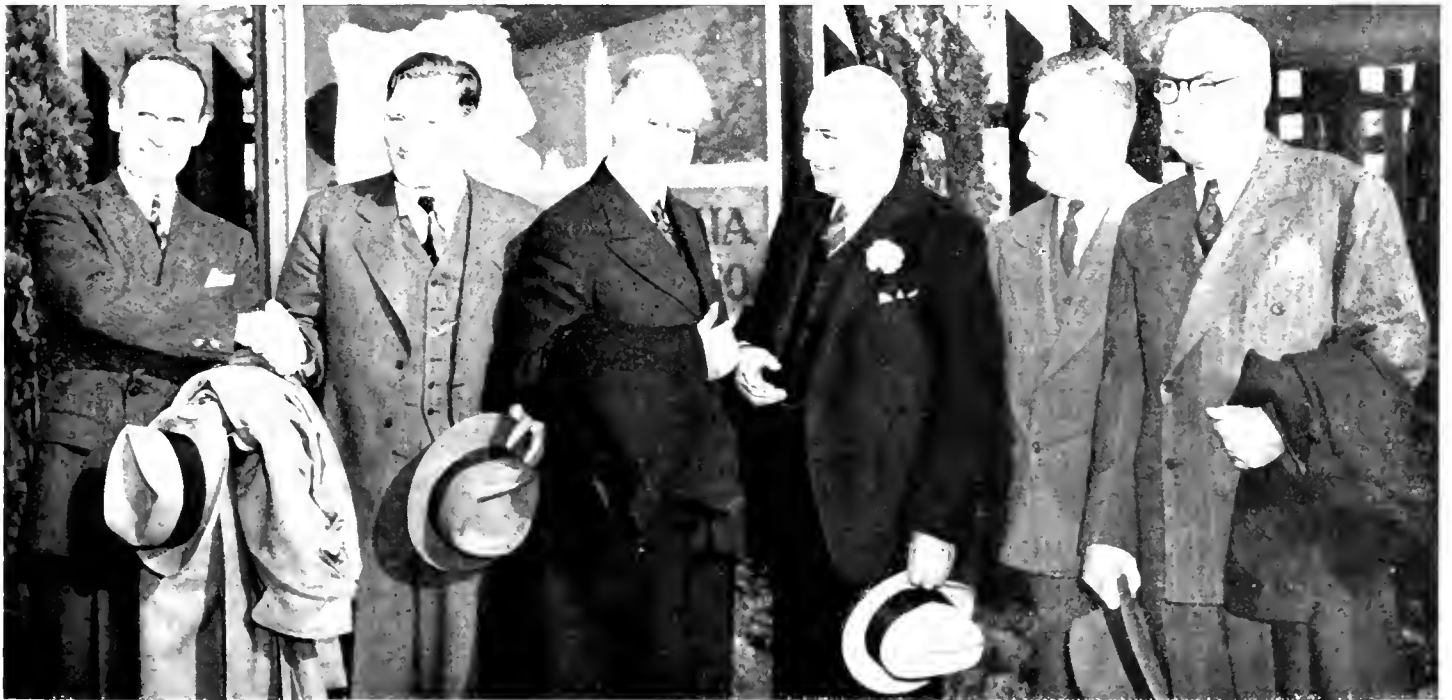
Operation and maintenance of the Bridge Railway is now in the hands of the railroads, a board of governors having been named by the railroads for management of the facilities. Named were R. E. Hallawell, General Manager of Interurban Electric; and William P. St. Sure, Vice President of the Key System. F. E. Sullivan was appointed Superintendent of the Bridge Railway and Orman Lutz was named Business Manager by the Board.

The construction chronology of the Bay Bridge Electric Railway facilities is as follows:

(Continued on page 28)



Terminal Plaza showing trolley car loop ramp to mezzanine level and street entrances for pedestrians and automobile passengers.



OFFICIAL GROUP—Left to right—Frank W. Clark, State Director of Public Works; Lieutenant Governor Ellis E. Patterson; Mayor William McCracken of Oakland; Mayor Angelo J. Rossi of San Francisco; John F. Hassler, City Manager of Oakland; and C. H. Purcell, Chief Engineer of Bay Bridge and its railway facilities.

Pacheco Pass Realignment Deletes 31 Curves, Steep Grades

By JNO. H. SKEGGS, District Engineer

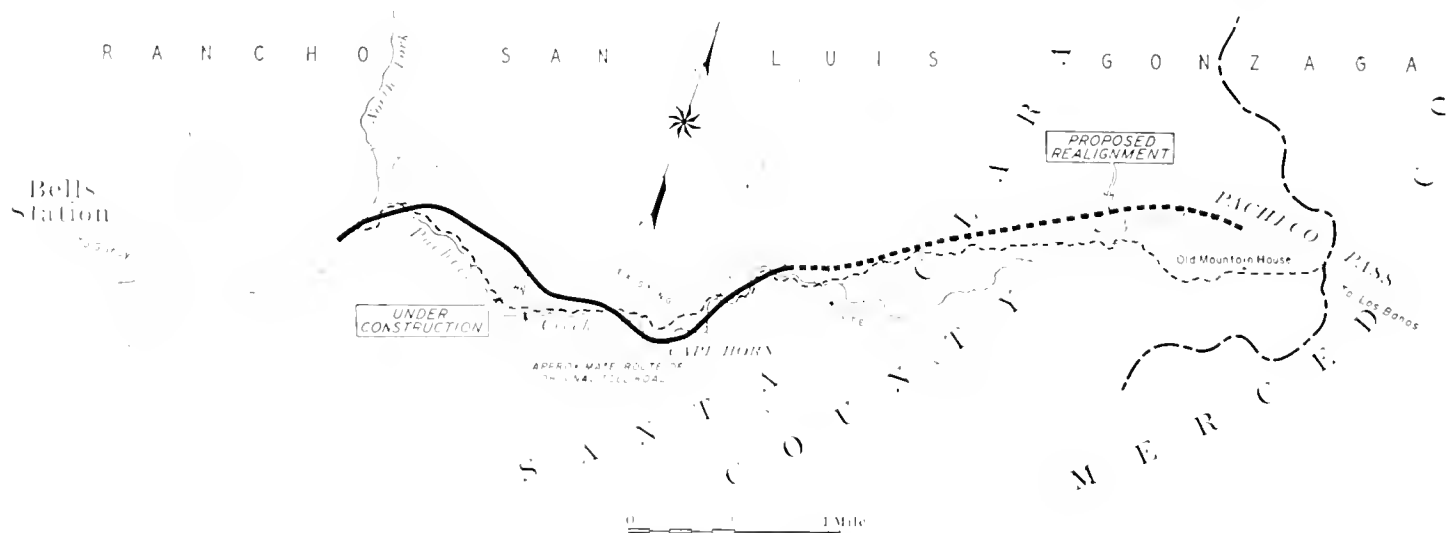
THE NAME "Pacheco Pass" recalls to surviving pioneers a memory of long ago when Indians used to cross to and from the fertile valleys by a trail which in after years developed into a stage road. This road became the route of stages traveling between San Francisco and New Orleans. The stage route was along a short toll road in eastern Santa Clara County which paralleled Pacheco Creek near the summit of the pass.

by Merced and Santa Clara counties, would have been to marvel at the progress made in ease of transportation. This county road served the area for many years until the route was included in the State highway system.

The first modern road to be constructed by the State was entirely over new rights of way in this same general territory of the former trails and roads and was built on standards of construction in accordance with

day. The corresponding July count was 1020 and 592, respectively. This so encouraged civic bodies of adjacent cities that the plea was soon made for the State to pave the highway in order to alleviate the dust which prevailed here and along many of our cross laterals. Paving operations soon followed section by section until the greater portion of the road was surfaced as a modern highway.

The annual increase in vehicular



Map shows old toll road along Pacheco Creek, the existing road, realignment under construction and the proposed realignment.

Remains of an old toll station which later became a house of shelter for the weary traveler of the early 60's is all but destroyed. The elements have gradually reduced this remnant until the present day reveals little more than the stone masonry foundation which is now a familiar landmark to those who travel this road between the Bay area and the lower San Joaquin River Valley.

To have ridden a stage over the rough road of 1856, as compared with the first county road, later completed

the early activities of the State Highway Commission. The year 1924 saw the Pacheco Pass highway graded, surfaced with gravel, and opened to traffic. Motorists then had their first opportunity to travel over the pass on a new, modern mountain road in far less time than it was possible to cover but a few miles on the pioneer road.

Early traffic counts taken by the State following completion of the first State highway showed approximately a count of 300 vehicles for a December Sunday and 187 for Mon-

traffic and the development of commercial carriers has steadily increased the flow of traffic over Pacheco Pass until the traffic count of July, 1937, indicated a Sunday volume of 2764 vehicles and a Monday count of 1611 vehicles. Heavy traffic of this volume over a relatively new cross-state lateral through sparsely settled country has opened a new avenue of fast transportation in central California.

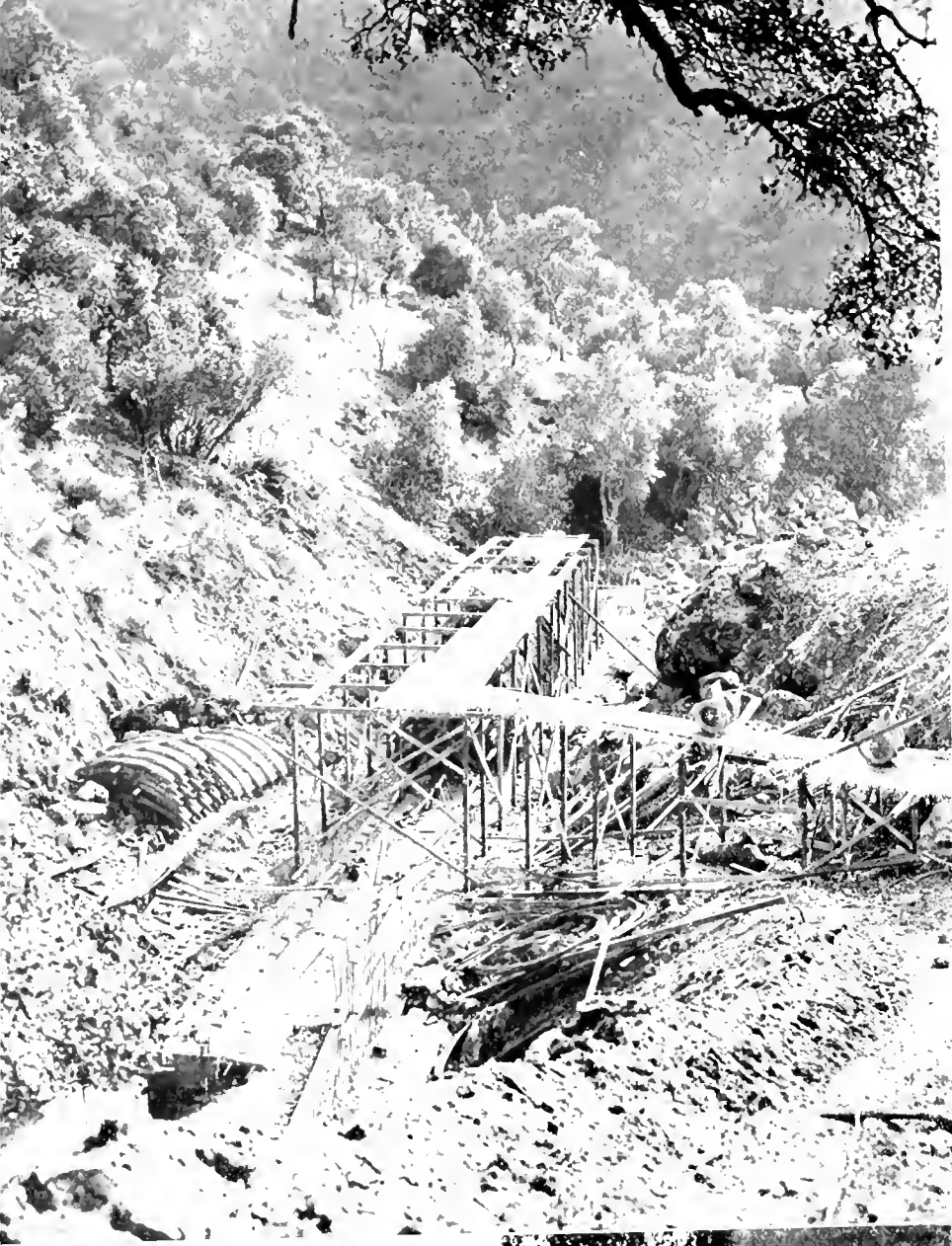
To modernize this route to present day standards in order to cope with increasing heavy traffic there re-



View of construction operations on section of Pacheco Pass realignment showing cuts and fills eliminating curves on upper level.



Several of the thirty-one sharp curves on Pacheco Pass mountain highway being eliminated by realignment project.



mained a six-mile section to be constructed in District IV between the north fork of Pacheco Creek and the summit. Funds within the current biennium in the amount of \$398,817 were sufficient to reconstruct the westerly 2.6 miles of the incomplete six-mile section. It is within this portion that heavy grades and sharp curvature prevail.

BIG EXCAVATION JOB

To remedy this condition a contract was recently awarded to Grandfield, Farrar & Carlin of San Francisco for reconstructing 2.6 miles of highway to be graded a normal road-bed of 36 feet and surfaced with gravel base and armor coat 22 feet wide, the seven-foot shoulders to be oiled treated. The principal item of the contract involves moving approximately 500,000 cubic yards of excavation. This together with some 35 other items of construction which include two bridges and six medium-sized arches are the major work features.

The heavy work involved in the contract extends over a period of 270 working days and the tentative date for completion is set for early in October of the current year, after which the many hazards and sharp curves of the old road will become but a memory.

The great benefit to be gained when this new 2.6 miles of road is completed may best be visualized by comparing the standards of the old with the new.

Old Highway

Length	3.46 miles
Total curvature	2,313 degrees
No. of curves	39
Minimum radius	100 feet
Maximum grade	7 percent

New Highway

Length	2.63 miles
Total curvature	295 degrees
No. of curves	8
Minimum radius	850 feet
Maximum grade	6½ per cent

It is readily noted that the new highway will save .83 of a mile in distance in this short length of road, and that the total curvature is re-

(Continued on page 27)

Two of the six steel and concrete culverts involved in the Pacheco Pass realignment are shown under construction. Contract includes two bridges.

"Highways of Tomorrow" Theme of Road Builders' Conventions in S. F.

WITH GOVERNOR Culbert L. Olson participating in the opening sessions, the American Road Builders Association and the Western Association of State Highway Officials, meeting concurrently in San Francisco during "Construction Week," March 6-9, will focus the 1939 highway spotlight on the Exposition City.

Mayor Angelo J. Rossi of San Francisco; Frank W. Clark, Director of Public Works of California; Thomas H. MacDonald, Chief, U. S. Bureau of Public Roads; Charles H. Purcell, California State Highway Engineer and representative of the American Association of State Highway Officials; H. G. Palmer, president of the Associated General Contractors, and Murray D. Van Wagoner, president of the American Road Builders' Association and State Commissioner of Highways of Michigan are also programmed as speakers.

On March 7, the American Road Builders and the Western Association of State Highway Officials will hold a joint meeting in the Civic Auditorium in San Francisco, convention headquarters. Other meetings to be held concurrently during "Construction Week" are those of the Associated General Contractors, Associated Equipment Distributors and the California Association of County Supervisors. These organizations will hold joint feature meetings on Tuesday and Wednesday evenings, March 7-8, on Treasure Island.

"The Road Builders' Convention will be particularly interesting at this time for its theme will be 'Highways of Tomorrow,'" said Charles M. Upham, Engineer Director of the Road Builders' Association. "Our association has for some time been making a study for a national system of highways to adequately carry present day traffic, something in the nature of a super-highway system.

"It is conservatively estimated that if our present highway system could be modernized so as to incorporate now known safety features, traffic accidents would be reduced 50 per cent. One highway authority has



CHARLES M. UPHAM

estimated as high as 75 per cent. Therefore, the program for 'Highways of Tomorrow' will be of interest to everyone.

"Soil stabilization is a subject of particular interest to highway officials and two entire sessions of the program will be devoted to it—embracing such phases as: Stabilometer data in the design of flexible road surfaces; the use of asphalt emulsions, calcium chloride, cement, and tar in soil stabilization; stresses in subgrade soils under rigid type pavements; stabilization principles in fill construction, and new developments in equipment for soil stabilization.

"At the General Technical Session on Thursday morning, March 9, reports will be made on: Design, construction and heavy grading, drainage and other subjects of current interest.

"The Safe Highway Sessions will include reports on: analysis of accident data; highway intersections and grade crossings; highway illumination; skid resistant qualities of road-way surfaces; alignment, grade and

right-of-way; guard rail; cross sections and roadside development; treatment of icy pavements and public education.

"Special sessions will be devoted to problems concerning municipal officials, county officials and other specialized groups.

"The Highway Contractors Session will include papers on fair trade practices, P.W.A. contracts and several other subjects of particular interest to contractors.

"Another interesting session will be devoted to the Pan American Highway. In addition the convention program will include meetings of particular interest to manufacturers of road building machinery and materials.

"The highway exhibit of the American Road Builders' Association will be held in the San Francisco Civic Auditorium. Already the outstanding manufacturers have made arrangements to display their equipment, including air compressors, crushers, mixers, engines, trucks, tractors, and various other items. One interesting exhibit will be an operating model of a complete asphalt plant. Another will be a truck mixer model arranged in such a manner as to make the entire operation visible. Many companies are arranging moving pictures showing their machines in operation.

"The convention forum is one in which road builders will be interested. It will present a review of what has taken place in highway development as well as present and future needs. There road builders may discuss their mutual problems and become acquainted with new ideas.

"Another inducement to attend this A. R. B. A. convention is the opportunity to see the Golden Gate Exposition. It will be in full swing at that time. Schedules may be so arranged as to attend convention sessions and the Highway Exhibit and at the same time get in a trip to Treasure Island.

"The San Francisco Hosts Committee, headed by State Highway En-

(Continued on page 24)

Detail Of Major Project Allocations Budgeted For

Items and amounts in parentheses indicate projects lie in two counties that will share the expenditure allocation shown opposite only one of the counties.

County	Route	Location	Approximate mileage	Proposed expenditure for construction and right of way
Alameda	69	6th and Fallon to Fruitvale Avenue	2 4	\$860,000
Alameda	107	Near Niles Niles Creek Bridges and Approaches	1 0	111,000
Alameda	108	Sunol to Livermore (portions); Arroyo del Valle Creek		150,000
Alameda-San Francisco	5-68	San Francisco-Oakland Bay Bridge (see San Francisco)		(1,000,000)
Alpine	23	Centerville Bridge	0 3	35,000
Amador	97	Jackson Creek Bridge and Approaches	1 5	85,250
Butte	3	South Boundary to Biggs Road	7 4	81,000
Butte	3	Pine Creek to North Boundary	0 4	21,000
Butte	3	17 Bridges between Marysville and Chico		22,500
Butte	87	Campbell Overflow Bridges and Approaches	0 2	18,700
Butte-Gienn	45	1 mile east Cherokee Canal to Sacramento River	10 0	75,000
Butte-Yuba	87	1/2 mile south to 1/2 mile north Butte County Line (see Yuba County)	1 3	(150,000)
Calaveras	24	At Line Creek	0 8	33,500
Calaveras	65	San Andreas to Angels Camp (portions)	3 4	171,350
Colusa	15	Long Bridge to Colusa	2 4	90,000
Colusa	15	3.4 miles east Williams to Long Bridge	2 4	25,000
Colusa-Yolo	50	Cache Creek Bridge northerly (portions)		75,000
El Dorado	11	Upper Truckee River Bridge and Approaches	0 3	42,500
El Dorado	11	2 miles east Phillips to 3 miles east Meyers	2 3	18,000
El Dorado-Sacramento	11	3 1/2 miles east Folsom to 2 miles east Clarksville (see Sacramento)	5 5	(295,000)
Fresno	4	Fowler to Selma	5 0	204,000
Fresno	41	1 mile north to 1 1/2 miles south Firebaugh; 2 canals	2 9	146,200
Fresno	41	Squaw Valley to Forest Boundary	3 0	153,000
Fresno	41	Boyden's Cave to Deer Cove	9 0	20,000
Fresno-Madera	125	San Joaquin River Bridge and Approaches	2 0	235,000
(Glenn-Butte)	45	1 mile east Cherokee Canal to Sacramento River (see Butte County)	10 0	(75,000)
Humboldt	1	North Scotia Bridge—Eel River	0 7	497,000
Humboldt	1	Robinson Ferry Bridge—Eel River	1 0	656,500
Humboldt	1	At Stegemeyer Bluff	0 4	10,000
Humboldt	1	Elks Creek Bridge near Miranda		51,000
Humboldt	46	Klamath River Bridge at Orleans		159,000
Humboldt	46	Weitchpec to Orleans (portions)		81,000
(Humboldt-Trinity)	20	Willow Creek to White's Bar (portion) (see Trinity County)		(240,000)
Imperial	26	Central Main Canal Bridge		15,000
Imperial	27	East Highline Canal to Gray's Well	24 5	250,000
Imperial	202	3 miles east Calexico to East Highline Canal	8 4	42,000
Inyo	23	Olancha to Cottonwood Creek	9 5	97,000
Inyo	23	3.3 miles north Alabama Gate to Independence	7 0	73,750
Inyo	23	2 miles south of Big Pine to Big Pine	2 0	34,850
Kern	4	Ft. Tejon to foot Grapevine Grade	5 7	510,000
Kern	23	5 miles north Rosamond to Mojave	7 8	94,190
Kern	23	12 miles north Mojave to Ricardo	13 6	62,630
Kern	58	Keene to Cable (portions)	5 0	366,000
Kern	58	Bear Mountain Ranch easterly	5 0	20,000
Kern	142	Beardsley Canal Bridge		20,000
Kern	58	Route 143 to Sivert	7 1	165,000
(Kern-Tulare)	129	Bakersfield to Ducor (portions)		110,000
Lake	49	Putah Creek to Route 15 (portions)		102,000
Lake	15	Clover Creek and Middle Creek Bridges		31,500
Lassen	28	Pit River and Overflow Channels Bridges		81,000
Lassen	29	Milford to Doyle (portions)	6 0	112,000
Lassen	73	Madeline to North Boundary (portions)	5 3	27,500
(Los Angeles-Ventura)	2	Ventura Boulevard; Calabasas to Conejo Grade (portions)		237,500
Los Angeles	60	Walnut Canyon to Winter Canyon (portions)	6 0	320,000
Los Angeles	23	Placerita Canyon to Solamint	± 3 5	350,000
Los Angeles	9	San Gabriel River Bridge Approaches		25,000
Los Angeles	205	Arroyo Seco Parkway (portions)		2,135,000
Los Angeles	26	Ramona Boulevard; Mission Road to West Covina (portions)		900,000
Los Angeles	26	Aliso Street separation at Mission Road		120,000
(Los Angeles-Ventura)	79	Castaic Junction to Santa Paula; Santa Paula and Piru Creek Bridges		300,000
Los Angeles	158	Sepulveda Boulevard; Centinella to Jefferson Boulevard	0 6	50,000
Los Angeles	172	3d Street; East city limits to Fetterly Avenue	1 7	280,000
Los Angeles	175	Strawberry Street; Artesia Avenue; Alameda to Normandie	5 0	360,000
Los Angeles	169	Bellflower Boulevard; Spring Street to Centralia	2 0	75,000

Construction of Highways In 91st-92nd Fiscal Years

Items and amounts in parentheses indicate projects lie in two counties that will share the expenditure allocation shown opposite only one of the counties.

County	Route	Location	Approximate mileage	Proposed expenditure for construction and right of way
Los Angeles	61	Verdugo Road; Glendale City limit to Foothill Boulevard	0 8	\$125,000
Los Angeles	165	Figueroa Street (portions)		425,000
Los Angeles	162	Santa Monica Boulevard; La Brea to Fairfax (cooperative)		80,000
Los Angeles	173	Olympic Boulevard (portions)		800,000
(Los Angeles-Orange)	166-174	Firestone-Manchester Boulevard (portions)		585,000
Los Angeles	61	Angeles Crest Highway; Cloudburst Summit to Mt. Islip		480,000
Los Angeles	161	Colorado Boulevard and El Modena; east city limits west		160,000
Los Angeles	156	Topanga Creek Bridge and Approaches		24,000
Madera	4	North Boundary to 2 miles south	2 0	47,000
Madera	4	Madera to $\frac{1}{2}$ mile south Cottonwood Creek; Bridge	2 9	200,000
Madera	125	Friant-Madera Road to $\frac{1}{2}$ mile north Kelshaw Corners	10 9	60,000
(Madera-Fresno)	125	San Joaquin River Bridge and Approaches (see Fresno County)	2 0	235,000
Marin	1	Grand Avenue in San Rafael to San Quentin Wye	1 6	869,000
Mariposa	18	Mariposa to 2.5 miles north	2 5	113,750
Mendocino	1	Outlet Creek to Reeves Creek	4 5	47,000
Mendocino	1	Crawfords Ranch to Ukiah; Robertson Creek	7 0	384,000
Mendocino	1	Haegneys to Bridges Creek Slide	1 1	99,000
Mendocino	16	Russian River Bridge		121,000
Mendocino	48	Flynn Creek to Navarro; Lazy Creek, Yorkville (portions)		101,500
Mendocino	56	Russian Gulch Bridge		172,500
Merced	4	Merced to Black Rascal Creek; Bear and Black Rascal Creek	1 5	254,500
Merced	4	South Boundary to 2.6 miles north	2 6	76,900
Merced	18	Merced to 5 miles east (portions)	5 0	80,000
Merced	32	7 Bridges east of Los Banos		46,000
Modoc	28	4 miles north Rush Creek to Pit River	7 7	280,000
Mono	40	East Boundary Yosemite Park to Gardisky's	2 5	68,000
Mono	96	Route 23 at Bridgeport, East Walker River Crossing	6 8	30,000
Mono	13	West Walker River Crossing to Route 23; 2 Bridges	2 3	75,050
Mono	111	4 miles south of Grant Lake to Grant Lake	4 0	69,850
Mono	13	Leavitt Meadow, Soda, Silver and Wolf Creeks		17,250
Monterey	2	South Boundary to Bradley; Salinas River Bridge	7 3	627,900
Monterey	2	2 miles south Greenfield to Soledad Bridge (portions)	5 0	198,300
Monterey	56	South Boundary to Sur River (portions)		80,000
Monterey	56	Big Sur River Bridge		51,500
Monterey	10	Peachtree Valley to Mustang Grade	5 0	213,500
Nevada	37	Donner Summit to $\frac{1}{4}$ mile west of Donner Lake	1 0	36,000
Nevada	17	$\frac{1}{2}$ mile south to 1.7 miles north Rattlesnake Creek	2 2	131,000
(Nevada-Placer)	37	Hampshire Rocks to $\frac{1}{2}$ mile west Soda Springs (see Placer County)	6 3	(75,000)
(Nevada-Placer)	38	Tahoe City to Truckee Wye (see Placer County)	14 6	(161,000)
Orange	2	South Boundary to Segunda Deshecha (portions)		150,000
Orange	184	Main Street Extension; Route 60 to Route 43; Newport Bay Bridge	6 4	200,000
Orange	43	Santiago Creek Bridge on Tustin Avenue		55,000
Orange	179	Through Garden Grove; Nutwood Avenue to Ninth Street	0 9	20,000
Orange	64	Route 2 to $\frac{1}{2}$ mile easterly	0 5	47,000
(Orange-Los Angeles)	166-174	Firestone-Manchester Boulevard (portions) (see Los Angeles County)		(585,000)
(Placer-Nevada)	37	Hampshire Rocks to $\frac{1}{2}$ mile west Soda Springs	6 3	75,000
Placer	37	Colfax Overhead to 0 7 miles north	0 7	55,000
Placer	17	Roseville to 0.6 mile east	0 6	17,500
(Placer-Nevada)	38	Tahoe City to Truckee Wye	14 6	161,000
Placer	39	Tahoe Wye through Tahoe City	1 0	15,000
Riverside	26	Junction Route 19 to 8th Street, Banning	5 8	213,025
Riverside	26	Banning to Junction Route 187	11 6	489,775
Riverside	19	Riverside to 3 miles west	3 0	231,000
Riverside	77	Temescal Canyon and Horse Thief Creek and Approaches	1 0	86,200
Riverside	187	Palm Springs to Cathedral City (cooperative)	9 5	188,500
Riverside	64	10 miles west of Hemet	3 5	59,500
Riverside	64	$\frac{1}{2}$ mile east Junction Route 146 to Blythe	2 2	62,000
Sacramento	3	American River to North Sacramento at Underpasses		44,000
(Sacramento-El Dorado)	11	3 $\frac{1}{2}$ miles east Folsom to 2 miles east Clarksville	5 5	295,000
Sacramento	11	Isleton to Walnut Grove	8 0	87,500
(Sacramento-San Joaquin)	53	Potato Slough to Mokelumne River and Bridge (see San Joaquin County)		(576,000)
San Benito	22	San Benito River Bridge		12,000
(San Benito-Santa Clara)	2	Sargent Overhead to 3 miles south Pajaro River; Pajaro River and S. P. R.R. Separation (see Santa Clara County)	1 9	(314,000)

DETAIL OF MAJOR PROJECT ALLOCATIONS BUDGETED FOR

Items and amounts in parentheses indicate projects lie in two counties that will share the expenditure allocation shown opposite only one of the counties.

County	Route	Location	Approximate mileage	Proposed expenditure for construction and right of way
San Bernardino	26	Redlands easterly (portions)	1 6	\$95,200
San Bernardino	9	Lytle Creek Bridge	---	25,000
San Bernardino	9	Malaga Grade Separation	---	15,000
San Bernardino	31	Mojave River to Junction Route 58	0 9	30,900
San Bernardino	43	Santa Ana River Bridge	---	83,500
San Bernardino	207	Route 190 to 5.1 miles north; City Creek	5 1	396,000
San Bernardino	190	Power House to Igo	3 0	106,400
San Bernardino	188	Mt. Anderson to Crestline	1 0	78,200
San Diego	12	La Mesa Overhead to El Cajon	4 6	284,000
San Diego	2	Las Flores Underpass to Onofre Overhead	7 2	15,000
San Diego	195-78	Lake Henshaw to Santa Ysabel	7 9	501,500
San Diego	2	International Boundary to 1 mile north San Ysidro	2 9	203,000
San Diego	198	San Diego River Bridge at Lakeside	---	187,000
San Diego	199	Coronado Heights line change	0 5	32,500
San Francisco	56	Funston Avenue Approach to Golden Gate Bridge	1 5	357,000
(San Francisco-Alameda)	5-68	San Francisco-Oakland Bay Bridge	---	1,000,000
(San Joaquin-Sacramento)	53	Potato Slough to Mokelumne River and Bridge	---	576,000
(San Joaquin-Stanislus)	110	Vernalis to Gates Road	7 6	140,000
San Joaquin	97	East of Clements to 1.5 miles north of Mokelumne River	1 5	103,300
San Luis Obispo	2	Miles Station Bridge and Approaches	---	295,200
San Luis Obispo	56	Santa Maria River Bridge	---	12,000
San Luis Obispo	56	Old Creek Bridge and Approaches	0 8	53,400
San Luis Obispo	56	Torro Creek Bridge and Approaches	0 5	45,500
San Mateo	68	South San Francisco to Burlingame-Structures	---	40,000
San Mateo	2	Broadway-Redwood City to South Boundary	4 5	661,800
San Mateo	56	Tunitas to Lake Lucerne (portions); San Geronio	6 0	340,000
Santa Barbara	2	Orella to Tajiguas Creek; Refugio Creek	2 6	276,000
Santa Barbara	2	Zaca to 3 miles south; Zaca Creek	3 2	304,900
Santa Barbara	2	Eagle Creek and Dos Pueblos Creek and Approaches	1 2	153,600
Santa Barbara	2	Sheffield Drive to San Ysidro Road	1 2	235,000
Santa Clara	5	Oaks to Los Gatos	1 6	353,500
(Santa Clara-Santa Cruz)	5	Inspiration Point to The Oaks	---	100,000
(Santa Clara-San Benito)	2	Sargent Overhead to 0.3 miles south Pajaro River	1 9	314,000
Santa Clara	42	Austin Corners line change	1 3	115,000
(Santa Cruz-Santa Clara)	5	Inspiration Point to the Oaks (see Santa Clara County)	---	(100,000)
Santa Cruz	116	Waterman Gap	1 1	53,600
Santa Cruz	56	Watsonville to Rob Roy Junction	7 3	485,000
Shasta	3	Pacific Highway relocation at Shasta Dam	11 6	430,000
Shasta	3	Olney Creek Bridge	---	15,000
Shasta	3	S. P. Subway to Hill Street	2 0	123,000

\$30,286,000 Estimated Cost to Modernize Roads in District XI

(Continued from page 5)

loads and speeds, and excessive maintenance expenditures are required in order to keep them in safe condition for even the restricted loads. Many of the bridges are too narrow, thus creating serious traffic hazards.

Similarly the obsolete or inadequate highways require heavy maintenance expenditures, consequently diverting funds to maintenance which should be conserved for construction and any other more urgent needs.

The following tabulation indicates

the probable cost to improve the present State highway system in District XI to adequate standards to serve present traffic. This estimate contemplates the continued utilization of stage construction, using bituminous treated surfacing on a large percentage of the secondary highway system for the reason that the amount of traffic on secondary roads does not warrant the use of asphalt concrete, cement concrete or other higher type surfacing.

	Miles	Estimated Cost	Total
Roads should be rebuilt	268.6	\$4,674,000	
Roads should be widened	220.3	3,684,000	
Roads should be relocated	312.3	15,018,000	
Total roads requiring Imp.	801.2		\$23,376,000

CONSTRUCTION OF HIGHWAYS IN 91st-92nd FISCAL YEARS

Items and amounts in parentheses indicate projects lie in two counties that will share the expenditure allocation shown opposite only one of the counties.

County	Route	Location	Approximate mileage	Proposed expenditure for construction and right of way
Siskiyou	3	Bailey Summit to State Line	1 4	\$150,000
Siskiyou	72	Route 3 at Weed to 1.5 miles north	1 5	71,000
(Solano-Yolo)	6	North of Dixon to 1 mile east Davis; Putah Creek	7 8	385,500
Solano	208	Sears Point Toll Road payment		85,602
Sonoma	1	Walls to junction Stony Point Road	3 2	327,000
Sonoma	56	Russian Gulch line change and Bridge	0 8	61,000
Sonoma	56	Timber Cove Creek Bridge and Approaches	0 3	18,000
Stanislaus	4	South Approach Turlock Overhead	0 3	11,500
Stanislaus	4	Keyes to Hatch Crossing	6 0	321,250
(Stanislaus-San Joaquin)	110	Vernalis to Gates Road (see San Joaquin County)	7 6	(140,000)
Tehama	7	Proberta to Red Bluff Subway; Oat, Coyote and Red Bank Creek	6 2	270,000
Tehama	3	Red Bluff to 5 miles north; Dibble, South Fork Blue Tent Creek	5 0	270,000
(Trinity-Humboldt)	20	Willow Creek to Whites Bar (portions)		240,000
Trinity	20	Oregon Mountain and Helena to Weaverville (portions)	15 0	183,000
Tulare	4	Kings River Bridge to North Boundary	1 3	62,700
Tulare	10	West City Limits Visalia to Route 10	1 3	103,000
Tulare	135	Tule River Bridge and Approaches		22,000
(Tulare-Kern)	129	Bakersfield to Ducor (portions) (see Kern County)		(110,000)
Tuolumne	13	Keystone to Jamestown (portions)	4 0	50,000
Tuolumne	65	Columbia Wye to Sonora; Woods Creek Bridge	2 5	174,000
Ventura	2	Springville to Beetox (portions)	2 0	79,000
Ventura	60	Point Mugu to Little Sycamore Creek (portions)		185,000
(Ventura-Los Angeles)	2	Ventura Boulevard; Calabasas to Conejo Grade (portions) (see Los Angeles County)		(237,500)
(Ventura-Los Angeles)	79	Castaic Junction to Santa Paula; Santa Paula and Piru Creek Bridges (see Los Angeles County)		(300,000)
Ventura	2	Bluffs north of Seac Cliff		45,000
Yolo	6	West end Causeway Structure		75,000
Yolo	6	1 mile east of Davis to Swingle	3 0	200,000
Yolo	7	Route 50 at Woodland to Cache Creek	3 7	152,000
Yolo	90	Madison to Dunnigan (portions)	4 0	101,500
(Yolo-Solano)	6	North of Dixon to 1 mile east of Davis (see Solano County)	7 8	(385,500)
(Yolo-Colusa)	50	Cache Creek Bridge northerly (portions) (see Colusa County)		(75,000)
Yuba	15	0.3 mile west Brucers Corners to Dry Creek	1 1	34,500
(Yuba-Butte)	87	¹ / ₂ mile south to ³ / ₄ mile north Butte County Line (see Butte County)	1 3	150,000

	No.	Estimated Cost
Bridges to be rebuilt or widened	66	\$516,000
Bridges—new	232	4,394,000
Total bridges required or to be improved	298	\$4,910,000
Rights of way		1,500,000
Safety devices—guard rails, islands, signals, etc.		500,000
Grand total		\$30,286,000

During the past four years the average annual expenditure in District XI, for major construction, has been \$1,400,000. On that basis and unless some additional financing is provided it will require 21

years to finance the rather limited improvements above contemplated, assuming that the mileage in the State Highway System remains the same and that the maintenance costs will not increase because of this extended delay.

It is quite evident also that during the 21 years necessary for accomplishment of the improvements as outlined, traffic demands will increase and additional development will be necessary to provide for same.

Reasonable progress demands a program of construction approximately three times that which now seems possible.

We know a fellow who's so mean, he not only pulls the wool over his girl's eyes, but it's ninety per cent cotton.

BUDGET FOR MAJOR PROJECTS \$28,066,102

(Continued from page 2)

the coming biennium, it will be necessary to expend on the Federal aid system about \$16,000,000 or 64 per cent of Division of Highways construction funds, exclusive of grade crossings, as these Federal funds must be matched with State funds.

The Federal aid system represents 6150 miles or 44 per cent of the total State highway mileage, which means that there will remain but 36 per cent of construction funds to cover construction on 56 per cent of the State system.

"I hear Cupid almost got you last week."
"Yes; I had an arrow escape."



Channelization Islands on Divided Highway link of U. S. 99 relocation in Selma have 6 inch recessed curbs.

Selma Divided Highway Opened

By E. T. SCOTT, District Engineer

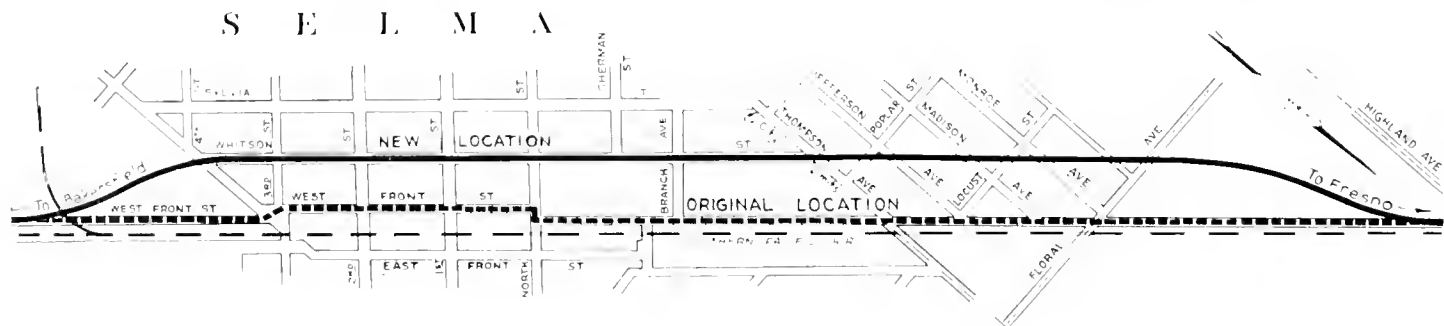
BACK IN 1913 when the State first constructed a highway to connect with West Front Street through the city of Selma, that ancient but faithful beast of burden, the horse, was very much in evidence. Early traffic counts taken in the vicinity revealed the fact that the horse outnumbered his new rival, the motor vehicle. The first count indicated 225 automobiles, 11 auto trucks and 328 horse-drawn vehicles

The 60-foot right of way and the two-lane pavement along West Front Street was ample to carry the traffic at that time. The fact that there was an abrupt jog in the highway at McCall Avenue and another jog at North Street, together with two spur track crossings a little farther to the north, was not of much concern. By the time the horse-drawn vehicles had dwindled to 4 in 1928 the autos and trucks had increased

to 3869 and 455, respectively. The stretch of highway through Selma had become a "bottleneck" and the jogs and spur crossings only aggravated the situation. The last ten years brought an increase of 53 per cent in automobiles and 140 per cent increase in trucks.

Studies were made to determine the most practical way of relieving the congestion through Selma. Busi-

(Continued on page 26)





Two views of Divided Highway on relocation of a short link of U. S. 99 in city of Selma. Separation strips are bordered by six inch curbs recessed and painted white to reflect headlight beams.

Pinole Grade Crossing Project Presents Many Difficulties

By E. L. WALSH, Assistant Bridge Construction Engineer

FOR the past four months motorists traveling from the San Francisco Bay area to the east and Sacramento Valley on U. S. 40 have been detoured around extensive construction operations in the town of Pinole. Because of the scope of the project, which extends for a distance of 3500 feet along the highway, many people have been unable to visualize the exact purpose of the work and how the completed project will look.

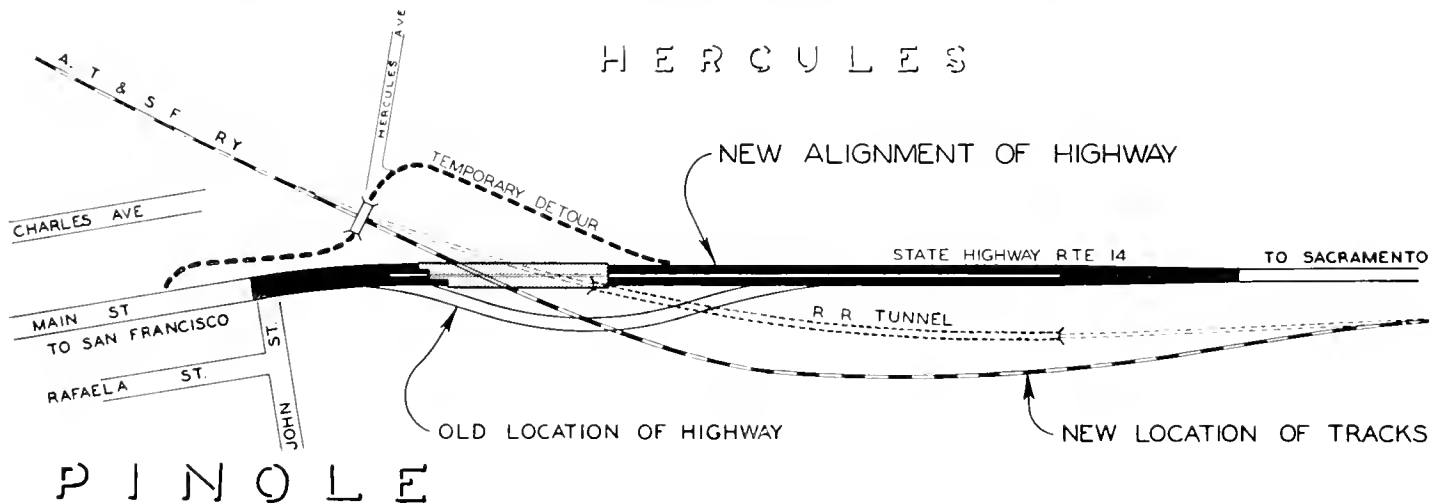
The original highway alignment utilized the Santa Fe Railroad tunnel as a means of crossing the railroad tracks. The old highway, which was

the removal of a row of eucalyptus trees which had been planted as an added protection in case of an explosion in the plant. It was necessary to readjust the alignment in order to cut down as few of these trees as possible.

The most satisfactory separation of grades involved not only the realignment of the highway, but the realignment of approximately 3500 feet of railroad track. The scheme of relocating the railroad track by means of an open cut in lieu of the existing tunnel was adopted because such a scheme can be accomplished with as little interference as possible with

and thin bedded shales that permitted speedy removal by adequate equipment.

The cut was excavated on 1:1 slopes, except in the slide area, where it was necessary to excavate on a 2:1 slope. As insurance against future slides, in certain areas in the cut where the section was excavated at a 1:1 slope, there were built two horizontal benches about 20 feet wide—one approximately 20 feet from the top and the other about 40 feet from the top. To stabilize the railroad roadbed, an elaborate subdrainage system, consisting of a line of 8-inch and 10-inch



within the limits of acceptable standards of construction at the time it was built, crossed over the top of the tunnel at the easterly entrance to the town of Pinole. The condition of the old timber-lined tunnel was such that the railroad company found it necessary either to reline the tunnel or relocate the roadbed in open cut.

Preliminary studies to effect this improvement involved many difficulties because of the expense of relocating the railroad track and because of the close proximity to the nitroglycerine plant of the Hercules Powder Company. The realignment involved

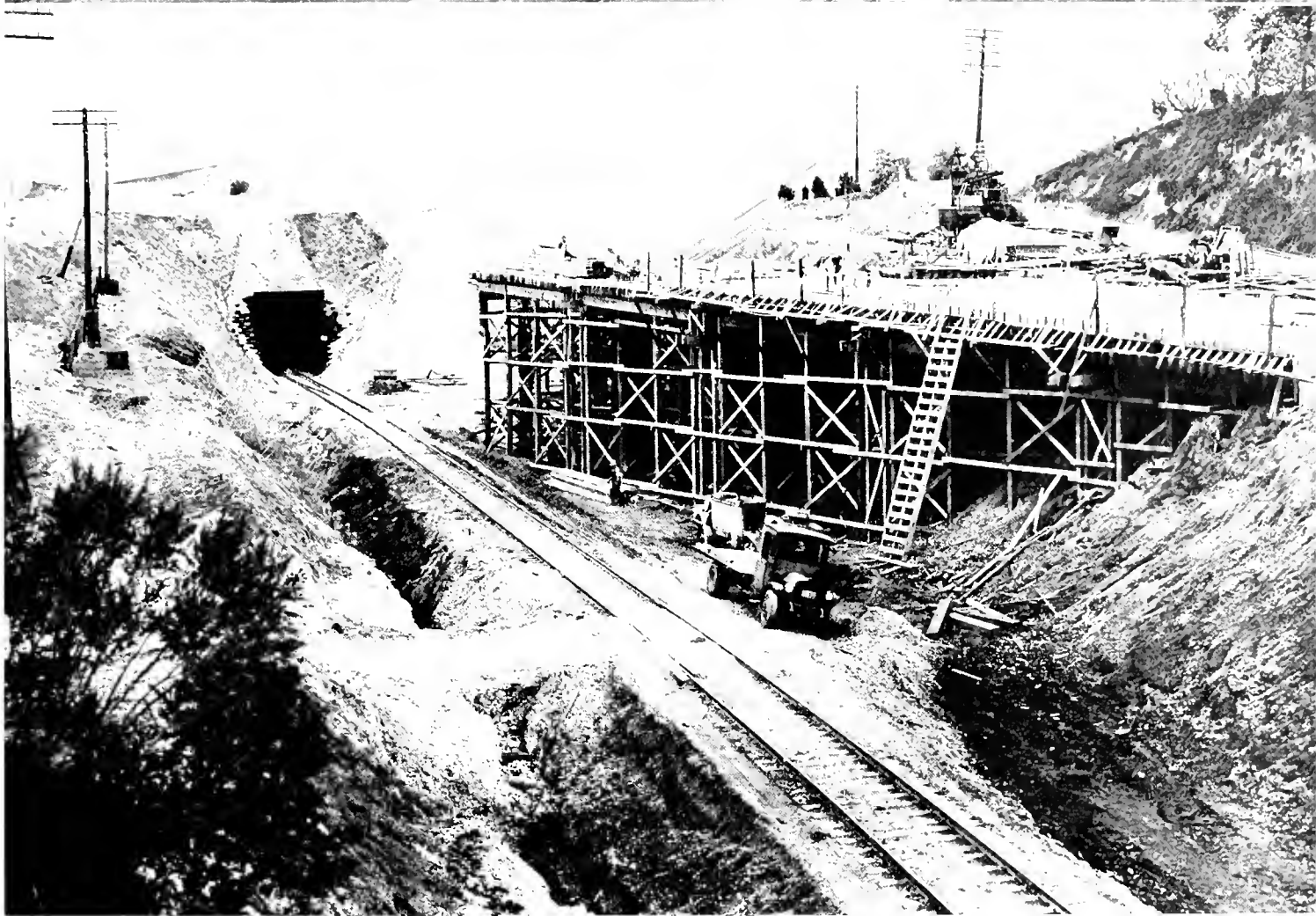
either highway or railroad traffic. The day-lighting and relining of the existing tunnel could not have been accomplished safely without removing train service for a period of thirty days. In making the relocation of the railroad track, it was also necessary to lower the railroad grade in order to avoid changing the highway grade in front of the developed property through the town of Pinole.

The railroad open cut, over 2700 feet in length and reaching a maximum depth of 90 feet, contained over 400,000 cubic yards of material. The material consisted of soft sandstone

perforated pipe, was laid longitudinally on each side of the roadbed, with transverse pipe at intervals of 20 feet.

The old highway alignment consisted of two 750-foot radii curves 100 feet of tangent, and a 1500-foot radius curve, all reversing. The change will increase the sight distance by substituting one curve of 2000-foot radius for the existing three reversing curves. It will also make possible an improved approach condition to the town of Hercules. The old approach to the one major industry of the town was over an old wooden bridge across the

(Continued on page 28)



Two views of extensive operations involved in realignment near Pinole of a link of U. S. 40 carrying heavy traffic between San Francisco and Sacramento, owing to the abandonment of a tunnel by the Santa Fe Railroad and relocation of route in an open cut. The existing highway crosses over the top of the tunnel. Its realignment on a straighter line will cross the railroad cut on a bridge. Upper photo shows highway detour and bridge operations without halting train or motor traffic. Below—Bridge construction near tunnel. New tracks will swing under this section of bridge permitting other half to be built.

Snow Plows Kept in Communication By Novel Radio Equipment

By T. H. DENNIS, Maintenance Engineer

ONE of the most difficult problems faced by highway maintenance forces in their annual fight to maintain an open road in the snow country is the lack of adequate communication with the men at the front.

With the first storm, wires go down in many sections, and are not repaired until Spring. In other locations, communication facilities are either inadequate, or nonexistent. Messenger service is impossible over blocked highways. In short, communication channels are most inadequate when snow removal crews need them the most.

A serious aspect of the failure of communication is lack of advice at the entrances to the storm area as to what roads are traversable. Lines of cars are held needlessly long at the barricades, or worse, are released too soon. When snow is drifting, conditions may change in thirty minutes, often resulting in many cars being trapped, unable to move either way.

PLAN FOUND FEASIBLE

The situation became so critical at the time of the heavy storms last winter that it was decided to investigate the possibility of using radio to supplement the existing channels of communication. In March a preliminary estimate indicated that the plan was feasible, and in August a detailed study of the system in use by the State of Washington led to a decision to equip at least one highway district in time for the snows of this winter. We are indebted to Washington for the splendid cooperation they gave us.

Highway District II has approximately 25 per cent of the snow removal road mileage, and maintains the main north and northeastern gateways to the State. It was decided to establish radio stations at the District Office in Redding, and at each superintendent's headquarters, as well as on all rotary snow plows.

A test car was equipped with radio in August and tests were made to provide data on which to base estimates of the kind of equipment and power required to provide reliable communication between the plows and their base, and between Redding and the maintenance stations. Not only are the air-line distances great in District II—105 miles from Redding to Alturas, 140 miles from Yreka to Quincy—but the rough terrain hides sections of highway in deep canyons making radio reception difficult.

DUPLICATE TRANSMITTER SETS

The specifications for the equipment, written in September, covered the following types of transmitters: 50-watt telephone and telegraph sets for Mt. Shasta City, Burney, Alturas, Mineral, Susanville, Quincy and Pulga. These sets are designed to work on either standard house current of 110 volts, 60 cycles, or on a 12-volt truck battery. The change-over is almost instantaneous, involving only the insertion of the power plug into another socket. These transmitters are duplicates, in size and controls of the snow plow sets.

Transmitters for the plows operate on telephone only, with a power of 50 watts. The power is supplied from the battery of the plow, high voltages being developed by a genemotor. So efficient is the design of these 50-watt transmitters that the drain on the battery, while transmitting, is less than the maximum charging rate of the generators on the plows. The transmitters are mounted on rubber washers to minimize shocks, and are practically waterproof.

The transmitters at Yreka and Redding are of 200 watts on the voice frequency and 350 watts on telegraph to insure constant communication with plows in the deep and winding Sacramento River Canyon. If experience this winter shows this to be unnecessary it is probable that

the Yreka transmitter will be replaced with the standard 50-watt set, and the larger unit moved to another district office.

SPEAKERS IN PLOW CABS

Receivers are of the fixed frequency type, permanently tuned to the assigned frequencies of 2726 kilocycles for voice and 3190 kilocycles for telegraph. Those in the stations have speakers mounted in them, while rotary plow receivers, being of remarkably small size, utilize a separate speaker mounted on the wall of the cab. The station receivers can be changed from 110-volt a.c. to 12-volt d.c. operation by turning one panel knob. The rotary plow receivers are, of course, for 12-volt operation only.

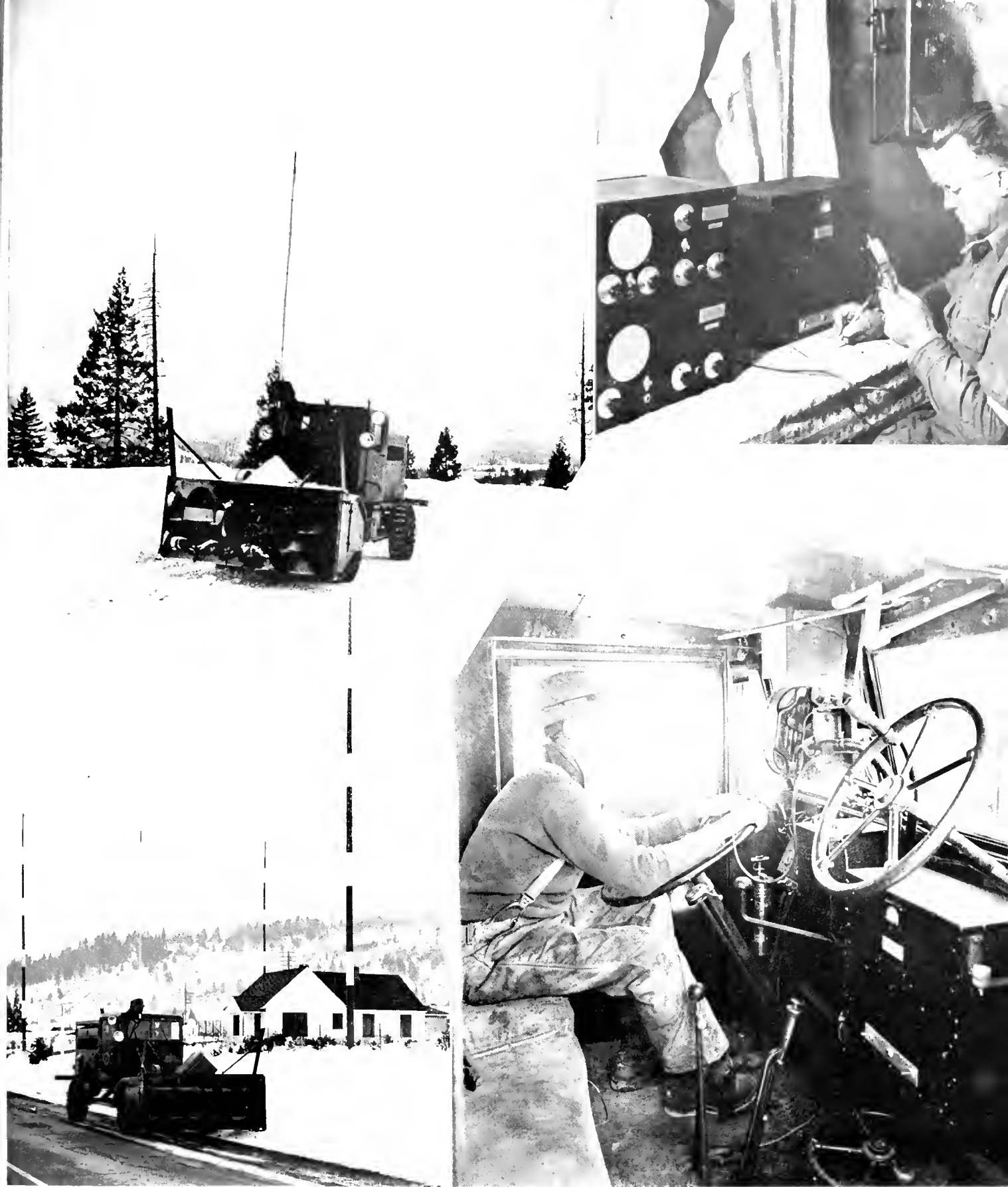
One of the difficulties encountered in the design of these stations was to plan efficient antennae for the land stations and the mobile units. It was found that there was a fine stand of red fir timber at various locations in the district, so at five of the stations three 100-foot poles were erected in the form of a triangle.

At Mineral, Quincy and Pulga advantage was taken of standing trees. The land station transmitting antenna is a half wave (171' 6" long), the receiving antenna being of the doublet type 140 feet long with a coil in the middle.

DIFFICULT ANTENNAE PROBLEM

Plow antennae presented a much more difficult problem however. After consideration of all the types heretofore used or available, development work was started on an entirely new type. When not in use the antenna lies back over the cab and body of the plow. In this position it extends only 12 inches above the cab, and does not extend back beyond the bumper.

When it is desired to transmit, the operator raises the antenna by means of a lever in the cab, so that it stands 12 feet vertically, then turns a small



Upper left—Radio equipped snow plow with antenna raised working in isolated mountain section of Shasta County. Upper right—Foreman R. E. Frost in Shasta City maintenance station, KATR (lower left), transmitting instructions to plow operator (lower right), who hears and talks over loud speaker equipment in front of him.

crank which extends it to a height of 23 feet. The operation requires less than ten seconds. This part of the equipment was built in the Sacramento shops. It is very rugged in construction, and has proved to be a highly efficient radiator.

As soon as announcement was made in District II that a radio system was to be installed, the question naturally arose as to who were going to operate the stations. A call was sent out for volunteers to study for the examination for Federal Communications Commission licenses. The result was amazing, and showed the fine spirit of loyalty and cooperation that pervades the maintenance personnel.

WIVES QUALIFY AS OPERATORS

Not only did the snow plow drivers and helpers, office workers and executives begin to study, but their wives too prepared for the examination, which was held at various points in the district. There are somewhere between 125 and 150 licensed radio-phone operators now available, and many are preparing themselves for the radio-telegraph examinations to be held before summer static forces use of telegraph instead of telephone communication.

The operating procedure has been greatly simplified by the use of printed forms upon which the daily road and weather report is compiled. A "round-robin" rapid fire exchange of information is accomplished in about 15 minutes each morning before the men go to work. At the end, each station in the system knows the condition of all roads in the district, the weather and temperature at each point, and the forecast for the next 24 hours.

Throughout the day there is an hourly time check, and plows in operation report each hour. A constant standby is maintained at all stations, and by all plows on duty, so that the district has an hour by hour picture of what is going on at the front, and the snowfighters know that they can report break-downs or call for assistance at any time. Only during storms is there a day and night watch.

BUILT BY MAINTENANCE MEN

The first equipment tests were made on January 16. From the various dates mentioned previously it can be seen that there was much day and night work involved in the period between the decision in late August to build the system and its advent on

Nicaragua and Mexico Express Appreciations

Consulado General De Nicaragua
San Francisco, California

January 24, 1939.

Mr. Frank W. Clark,
Director of Public Works,
Sacramento, California.

Sir:

I have the pleasure to acknowledge receipt of the January, 1939, edition of "California Highways and Public Works," in which I am informed that you have been appointed Director of Public Works and that you have assumed your official duties.

"California Highways and Public Works" is especially valuable to my government. I do not like to impose upon your good nature, but I am very interested in securing three copies of each edition, and if it is possible for you to send them monthly I will be grateful to you.

The Honorable Dr. Antonio Flores-Vega, Minister of Public Works of the Nicaraguan Government, has read every edition I have sent him and found it contains interesting articles about modern design and full research applied to highways constructions.

With my congratulations and best wishes, please accept the assurance of my esteem and consideration.

Sincerely,

JUAN JOSE MARTINEZ LACAYO,
Consul General of Nicaragua.

BIBLIOTECA NACIONAL DE MEXICO

Senor John W. Howe, Editor,
Public Works Building,
Sacramento, California.

Through the kindness of the Department of Public Works (Division of Highways), for which we are very thankful, we have been receiving regularly two copies of your interesting publication.

In view of the constantly increasing interest that highway problems are awakening in our Country, I wish to ask if you can not increase the number of copies of your publication to five. These will be properly used, two copies for our use and three copies distributed among those persons and institutions to whom they will be especially useful.

Thanking you in advance for this favor, I remain

Yours very truly,

The Director (Mexican National Library) Manrique (Signed)
Prof. Aurelio Manrique, Jr.

the air in January. Manufacturers worked night shifts on the equipment, maintenance men worked night shifts on installation, and the weather man cooperated by holding off the first real snow until the system was ready.

All of the details of planning the system, preparing specifications and superintendent manufacture, construction and installation have been handled by regular employees of the maintenance department of the Division of Highways. The chief operator and service man at Redding is the only employee whose time is devoted exclusively to radio work, the operation of all other equipment being performed by regular employees as part of their routine duties.

With the experience gained in District II this winter it is hoped that an even more efficient installation can be developed in several other districts before the coming winter. A preliminary survey has already been conducted in Districts I, III, VIII and IX.

ROAD BUILDERS SWARMING IN SAN FRANCISCO

(Continued from page 13)

gineer Purcell of California, and including many prominent business men have arranged a most interesting program."

The Western Association of State Highway Officials will hold its 18th annual convention in the Fairmont Hotel, San Francisco, March 6, 7, 8 and 9. Topics of discussion at the March 7 session will include "The Safety Problem" and "Enforcing Time Limits on State Highway Contracts." Delegates will attend other group meetings and participate in the Construction Congress at Treasure Island on Wednesday, March 8. Discussion topics for March 9 include "Soil Studies" and papers to be read by Dr. H. I. Hewes, Deputy Chief Engineer, U. S. Bureau of Public Roads; Floyd Boone, Secretary-Manager Northern California Chapter of Associated General Contractors, and others.

Father—So you've been fighting and lost all your front teeth.

Son—Oh, no, Dad, I've got them right here in my pocket.

First Playwright—Gosh, that suit of yours looks as though it had been slept in.

Second Playwright—It was. I wore it to your new show last night.



THE activities of the Division of Water Resources in connection with the Central Valley Project have included engineering studies and the preparation of data for negotiations with various interests in connection with the acquisition of water rights, and negotiation for the relocation of public utilities. Studies were also continued on matters affecting the disposal of water and power made available by the project. In this connection conferences were held with Kern County interests and studies made of the possible exchange of water supplies from the Central Valley Project for supplies from Kern River which would be transferred to areas south of the river.

A review and study was made of a petition before the Railroad Commission of the State of California in the matter of the application of the San Joaquin and Kings River Canal and Irrigation Company for an order authorizing it to enter into a contract for the exchange of San Joaquin River water for water made available by the San Joaquin pumping system.

Work was completed on the preparation of a report on the acquisition of and plan of exchange for rights of the Edison Securities Company to water from the San Joaquin River proposed to be acquired for the use of the Central Valley Project.

Negotiations were continued with public utility companies for the relocation of power and communication facilities for the completed Central Valley Project and for temporary relocations necessitated by construction activities.

IRRIGATION DISTRICTS

Carmichael Irrigation District completed a pipe line replacement project during the month that has been in progress for the past two years with the aid of WPA labor. About 67 per cent of the old system has been renewed with welded steel pipe, and

several miles of wood stave lines have been rebanded. Total expenditures on the improvements made were in excess of \$37,000.

Nevada Irrigation District has a crew of 125 men employed at the Scott's Flat dam site five miles above Nevada City. The work of clearing brush and digging test pits will be carried on during the winter months in preparation for later construction of the project, for which a bond issue of \$253,000 was recently voted.

Refinancing plans of Merced, Lindsay-Strathmore, and James irrigation districts were approved as fair and equitable to creditors in an important decision of the Federal District Court issued this month at Fresno. The decision is the first to be made for a number of similar cases in which the districts are attempting to complete their refunding operations under the Federal Municipal Bankruptcy Act.

SUPERVISION OF DAMS

Construction is progressing satisfactorily on Palos Verdes Reservoir in Los Angeles County.

The Metropolitan Water District has filled Gene Wash Dam and is now filling Copper Basin Dam.

The repairs and alterations on a number of dams of the Los Angeles County Flood Control District have all recently been completed. This work included trash racks and improvements to various spillways.

Work on the spillway at the Saw Pit Dam is well under way as is the work on the spillway at the Little Rock Dam.

WATER RIGHTS

Fifteen applications to appropriate water were received during December; 5 were denied; 20 were approved; 7 permits were revoked and 2 licenses were issued.

During the month 198 reports were received from permittees and licensees and these with other similar reports previously received are under study. Progress is also being made in the preparation of reports in connection with the 228 projects which were inspected during the year.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month activities have been for the most part centralized on the office work necessary in order to compile and publish the annual mimeographed report. This

report will show the diversions, acreages irrigated, stream and return flows in the Sacramento and San Joaquin valleys.

A field survey of the crops in the Sacramento and San Joaquin Delta is virtually completed and the results are now being tabulated for inclusion in the annual report of this office.

The sampling of water in the delta for salinity is being carried on at all regular stations in order that the record of the seasonal advance and retreat of salinity may be complete. The Sacramento and San Joaquin rivers still remain at low stages. For purposes of comparison, some salinity and stream flow figures are given.

CALIFORNIA COOPERATIVE SNOW SURVEYS

With about two feet of snow in the mountains as a result of the early winter storms, rangers of the Lassen and Plumas National Forests were instructed in the details of making snow measurements at the snow courses established this year in their areas. Later in the month, snow surveying instruction was given to a class of 20 rangers from six national forests who had gathered at the Auburn Ski Club near Cisco for a course in ski instruction.

The end of January snow surveys are now being made at the key courses throughout the mountains. Some of the measurements have been received and preliminary work is being done preparatory to issuing the first snow survey bulletin of the 1939 season, scheduled for release about February 10th.

SPECIAL INVESTIGATIONS

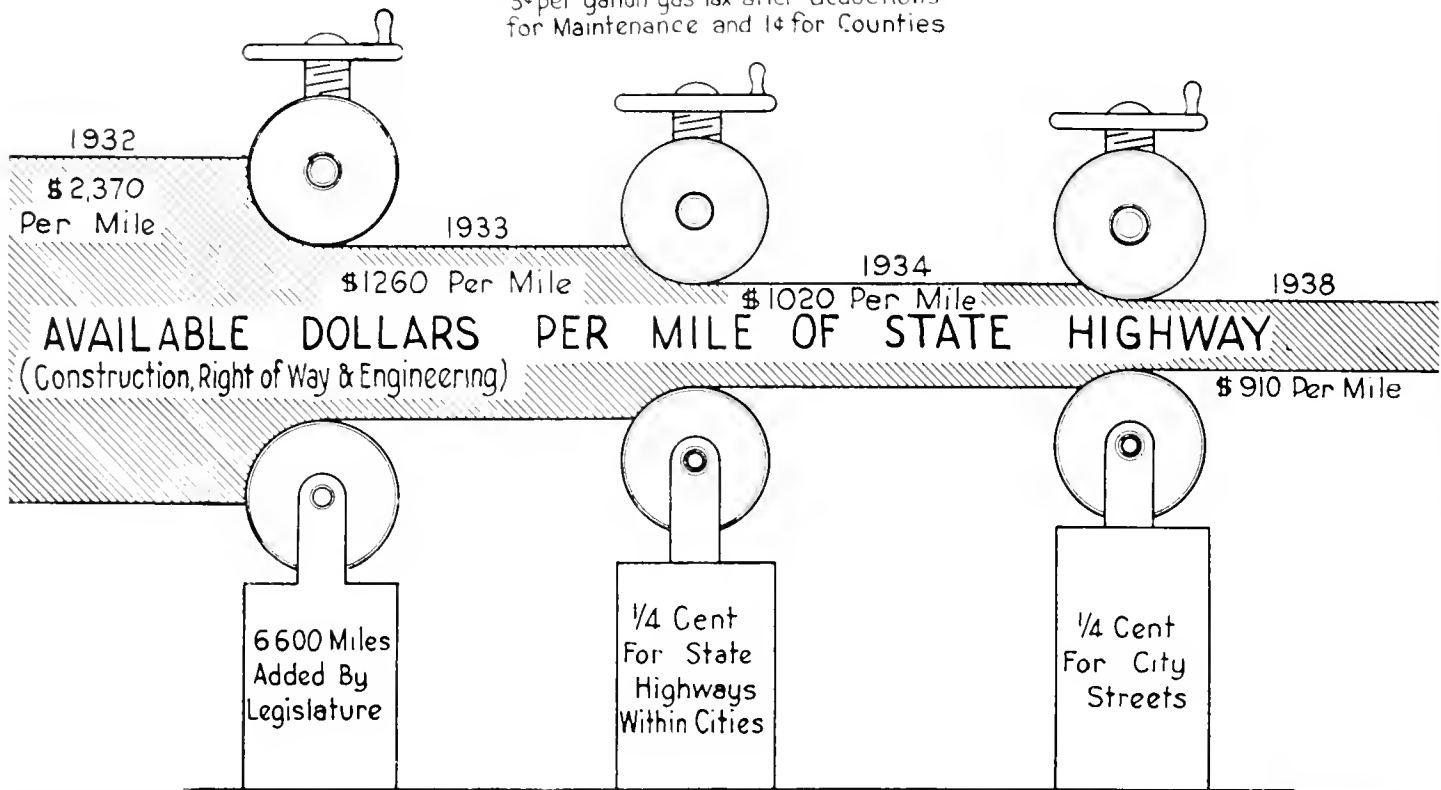
Flood Damage Repairs

Only one application was received during the month for an allotment from money appropriated from the Emergency Fund by Chapter 11, Statutes of 1938, Extra Session, for the restoration of property, levees, flood control works, county roads and bridges damaged by the floods of the 1937-38 winter season. During the month Senate Bill No. 421 restoring \$795,445.51 to the Emergency Fund for flood damage repairs and restoration was passed unanimously by both houses of the Legislature. This sum, by the provisions of the bill, will be available only to applicants who made requests for assistance prior to the effective date of the act.

Investigation and preparation of reports on work for which applications for allotment of funds have been made continue.

STATE HIGHWAY GAS TAX FUNDS THROUGH THE ROLLING MILL

Note Figures derived from funds available from
3¢ per gallon gas tax after deductions
for Maintenance and 1¢ for Counties



Divided Highway Opened Through City of Selma

(Continued from page 18)

ness had built up along the 60-foot right of way on West Front Street to such an extent that the cost of additional right of way there was prohibitive. By building an alternate route along Whitson Street one block west, a considerable saving could be effected. Besides, the "jogs" could be avoided and the two spur track crossings eliminated.

After careful consideration the State Highway Commission adopted the present new route. A 100-foot right of way was secured and a divided highway consisting of two 23-foot asphaltic concrete pavements with a 6-foot separation, were constructed.

The separation between the north-bound and south-bound traffic lanes consists of curbs with low growing shrubs, *Pyraeantha Formosiana*, planted between.

The curbs along the dividing strip are recessed in order to better reflect light from the curb face. The recessed area normal to the direction of the headlight rays has been painted white. These curbs stand six inches above the pavement surface, are 8½ inches wide at the bottom and 5 inches wide at the top, with the entire slope on the front face of the curb.

Along both sides of the divided highway have been planted eucalyptus trees of the *Sideroxylon Rosea* variety.

Temporary transitions to connect with the old highway both north and south of the improvement were provided. As funds become available the existing two-lane pavement extending from Selma to Fowler and also from Selma southerly to Kingsburg, will be reconstructed to provide for a divided highway.

The improvement through the city of Selma is only one short link in that long and important transportation route, U. S. 99, which connects the metropolitan area of Los Angeles with Sacramento and the San Francisco Bay region.

Heavy traffic composed of 16 per cent to 20 per cent trucks, now carried on this route, justifies a divided highway along its full length. However, unless more funds are made available it will be many years before this important highway can be made adequate for the traffic imposed upon it.

The improvement through Selma was made under contract by the Union Paving Company. Dan Morrison was superintendent for the contractor, while Fred Howard was resident engineer for the State Division of Highways. The highway was officially opened Dec. 10, 1938.

Highway Bids and Awards for the Month of January, 1939

LOS ANGELES COUNTY—Between North Main St. and Mission Road about 0.1 mile to be graded and paved with asphalt concrete, portland cement concrete and plant-mixed surfacing. District VII, Route 4, Section L.A., George R. Curtis Paving Co., Los Angeles, \$50,276; Griffith Co., Los Angeles, \$53,361; Radich & Brown, Burbank, \$53,368; Oswald Bros., Los Angeles, \$56,933; Robert M. Price, Huntington Park, \$59,780; P. J. Akmalzich, Los Angeles, \$64,524. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$49,693.

MENDOCINO COUNTY—About 10 miles south of Fort Bragg, a bridge across Jack Peters Creek to be constructed and about 0.22 mile of roadway to be graded and penetration oil treatment applied thereto. District I, Route 56, Section E. A. Soda & Son, Oakland, \$42,591; C. W. Caletti & Co., San Rafael, \$43,146; Fred J. Maurer & Son, Eureka, \$43,808; Guerin Bros., San Francisco, \$39,401; Joseph Shaw, Oakland, \$40,106; Albert H. Siemer & John Corcano, San Anselmo, \$41,177; Harold Smith, St. Helena, \$41,869; J. M. Walker, Berkeley, \$42,019; Valley Construction Co., San Jose, \$44,242; E. E. Smith, Eureka, \$44,805. Contract awarded to M. A. Jenkins, Sacramento, \$36,572.50.

MERCED COUNTY—About 17.4 miles east of Los Banos, redecking and widening a bridge across Fresno River. District X, Route 32, Section C. C. W. Caletti & Co., San Rafael, \$17,802; F. Kaus, Stockton, \$20,695; L. C. Seidel, Oakland, \$18,671; M. A. Jenkins, Sacramento, \$14,628. Contract awarded to A. A. Tieslau, Berkeley, \$14,134.50.

MONO COUNTY—Between Benton Station and Nevada State line, about 7 miles to be graded and road-mix surface treatment and Class "A" seal coat to be applied. District IX, Route 76, Section B. Basich Bros., Torrance, \$52,376; R. L. Oakley, Pasadena, \$52,757; Nevada Rock & Sand Co., Inc., Reno, \$54,725; Oswald Bros., Los Angeles, \$55,259. Contract awarded to J. A. Casson, Hayward, \$49,877.20.

RIVERSIDE COUNTY—Between Orange County line and Corona, about 4.8 miles to be graded and paved with plant-mixed surfacing and portland cement concrete. District VIII, Route 43, Section A. J. A. Haddock, Ltd., Pasadena, \$184,499; Griffith Co., Los Angeles, \$185,041; United Concrete Pipe Corp., Los Angeles, \$187,365; Oswald Bros., Los Angeles, \$188,822; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$191,780; Basich Bros., Torrance, \$205,946; Claude Fisher Co., Ltd., Los Angeles, \$207,123; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$209,371; Hemstreet & Bell, Marysville, \$211,320; Clyde W. Wood, Los Angeles, \$212,964; Sully-Miller Contracting Co., Long Beach, \$215,450; Matich Bros., Elsinore, \$230,132. Contract awarded to V. R. Dennis Construction Co., San Diego, \$172,463.95.

SAN BERNARDINO COUNTY—Across San Antonio Wash, about $\frac{1}{2}$ mile east of Los Angeles County line, a reinforced concrete slab bridge to be constructed; and about 0.2 mile to be graded and paved with asphalt concrete. District VIII, Route 26, Section C. J. E. Haddock, Ltd., Pasadena, \$46,189; Oscar Oberg, Los Angeles, \$46,445; White & Wilberg, Santa Monica, \$47,753; Dimmitt & Taylor, Los Angeles, \$48,125; J. S. Metzger & Son, Los Angeles, \$49,805; R. R. Bishop, Long Beach, \$49,813; C. O. Sparks

In Memorium

Sam G. Judd

With the passing of Sam G. Judd of Los Banos, District X of the Division of Highways lost a valued and loyal employee. Mr. Judd is mourned by his many coworkers and hundreds of friends in Mariposa and Merced counties.

Mr. Judd entered the service of the Division of Highways on February 5, 1924, and at the time of his death was foreman in District X to which he was transferred from District VI on September 1, 1933. As a supervisor, Mr. Judd won the respect and friendship of the men of his crew and by his superiors was considered an authority on pavement repairs and patching. He carried on his road work with responsibility and conscientious concern. His daily life was an inspiration to all who knew him.

Members of Mr. Judd's crews who worked through long, wet winter nights gratefully remember the hot coffee and sandwiches served to them at frequent intervals by Mr. and Mrs. Judd.

Mr. Judd was born in Silver City, New Mexico, October 8, 1891. He was engaged in ranching before he entered the employ of the State. He leaves a widow, Loretta, to whom is extended the deepest sympathy by the entire personnel of the Division of Highways.

PACHECO PASS REALIGNMENT DELETES 31 CURVES

(Continued from page 12)

duced 2018 degrees, a saving of over $5\frac{1}{2}$ complete circles. 31 curves having been eliminated and the minimum radii very materially increased. The saving of one-half per cent in maximum grades will be an improvement beneficial to heavy loaded vehicles.

The accompanying map shows the approximate route of the old original highway and toll road following the Pacheco Creek past Cape Horn and the old Mountain House to the summit. The existing State highway route constructed in 1923 far up on the mountain side and following the upper reaches of the east fork is also indicated.

and Mundo Engineering Co., Los Angeles, \$52,018; Valley Construction Co., San Jose, \$51,910; Byerts & Dunn, Los Angeles, \$58,057; The Contracting Engineers Co., Los Angeles, \$62,832. Contract awarded to G. E. Kerns, Long Beach, \$41,862.50.

SAN BERNARDINO COUNTY—Across Mojave River at Baker, a bridge 408 feet in length consisting of timber stringer spans with concrete deck on pile bents; roadway approaches to be graded, imported surfacing material placed thereon and roadmixed surfacing treatment applied. District VIII, Route 31, Section K. Valley Construction Co., San Jose, \$36,022; White & Wilberg, Santa Monica, \$36,078; S. A. Cummings, San Diego, \$36,603; E. G. Perlman, Los Angeles, \$37,120; J. S. Metzger & Son, Los Angeles, \$37,246; J. A. Casson, Hayward, \$36,385; Ralph O. Dixon, Glendale, \$39,735; George Herz & Co., San Bernardino, \$40,165; Byerts & Dunn, Los Angeles, \$42,326; A. S. Vinnell Co., Alhambra, \$46,530. Contract awarded to R. M. Price, Huntington Park, \$35,924.90.

SAN BERNARDINO COUNTY—Between Devore and Camp Cajon, about 2.4 miles to be graded and surfaced with plant-mixed surfacing. District VIII, Route 31, Section B. Geo. Herz & Co., San Bernardino, \$149,912; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$156,794; Claude Fisher Co., Ltd., Los Angeles, \$159,765; Guerin Bros., San Francisco, \$167,047; A. Teichert & Son, Inc., Sacramento, \$188,377; United Concrete Pipe Corp., Los Angeles, \$234,929. Contract awarded to W. E. Hall Co., Alhambra, \$149,510.35.

SANTA BARBARA COUNTY—Between Santa Ynez River and San Antonio Creek, about 10 miles to be graded and portions to be treated with liquid asphalt by the road-mix method and seal coat applied. District V, feeder road. Piazza & Huntley, San Jose, \$64,631; R. L. Oakley, Pasadena, \$64,953; C. G. Willis & Sons, Inc., and Chas. G. Willis, Los Angeles, \$66,278; United Concrete Pipe Corp., Los Angeles, \$66,567; W. E. Hall Co., Alhambra, \$67,547; Basich Bros., Torrance, \$68,172; J. E. Haddock, Ltd., Pasadena, \$71,604; Parish Bros., Eldridge, \$72,835; Granite Construction Co., Ltd., Watsonville, \$73,526; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$75,425; Guerin Bros., San Francisco, \$75,531; Oswald Bros., Los Angeles, \$77,951; Valley Construction Company, San Jose, \$79,012. Contract awarded to Mountain Construction Co., Sacramento, \$58,059.15.

SISKIYOU COUNTY—Between $\frac{1}{2}$ mile east of Hamburg and Scott River, about 1.4 miles to be graded. District II, Route 46, Section C. Guerin Bros., San Francisco, \$36,053; A. Soda & Son, Oakland, \$36,252; Claude C. Wood, Lodi, \$36,216; Harold Smith, St. Helena, \$38,226; J. M. Walker, Berkeley, \$38,245; Poulos & McEwen, Sacramento, \$38,324; Young & Son Company, Ltd., Berkeley, \$38,567; Wm. von der Hellen, Yreka, \$38,840; Larsen Bros. and Harms Bros., Sacramento, \$11,992; John Burman & Sons, Eureka, \$44,423; West Construction Company, San Francisco, \$44,545; Bennett & Taylor, Los Angeles, \$45,389; J. P. Brennan, Redding, \$53,377; Valley Construction Company, San Jose, \$65,458. Contract awarded to Hemstreet & Bell, Marysville, \$31,494.

A wife's an angel until she begins harping.

Pinole Grade Crossing Project Presents Many Difficulties

(Continued from page 20)

Santa Fe tracks with a very narrow intersecting road at the westerly end.

This section of highway is in the direct line of heavy auto and freight traffic between the East Bay cities and the Sacramento Valley. Its improvement will correct the substandard condition now existing. An average daily traffic of over 8000 vehicles passes this point. The Sunday traffic amounts to more than 12,000 vehicles.

DETOUR CONSTRUCTED

It has been necessary to maintain close cooperation between the railroad and highway construction operations in order to facilitate an early completion of the project. The maintenance of uninterrupted service on both the railroad and highway demanded close coordination in executing the various phases of the work in the proper sequence. Inasmuch as the railroad cut completely blocked and destroyed the old highway, and since there were no available roads over which highway traffic could by-pass the project, it was necessary to construct a highway detour around the work.

The construction and maintenance of such a detour involved the expenditure of approximately \$14,000. This amount was exclusive of the cost of the detour bridge which is to remain in place to serve as a permanent connection to the town of Hercules. Of this amount, approximately \$2,000 was required for the installation of warning signs, lights, traffic stripe and guard rail to warn and protect the traveling public.

HIGHWAY BRIDGE BUILT

The realignment of the railroad track, substituting an open cut for the existing railroad tunnel, makes necessary the construction of a highway bridge to span the track. This structure requires new alignment for the highway approaches which are being constructed to a standard divided highway with a 4-foot dividing strip.

The dividing strip separates two 23-foot highway lanes, each of which has a 7-foot shoulder. The 23-foot pavement lanes will be surfaced with six inches of crusher run base topped with three inches of plant mixed surfacing. The shoulders will be given a penetration oil treatment. The divid-

ing strip will be inclosed between concrete curbs. At each end of this section the dividing strip will be carried to the end of the vertical curves, and there will be a 400-foot transition in pavement width, narrowing down to bring the 4-lane pavement to the existing 3-lane pavement width.

At the west end the dividing strip will terminate in the restricted speed zone area within the city limits of Pinole, and the nose of the dividing strip will be provided with 3-inch ruby reflectors. At the east end, due to the faster speed of traffic approaching the divided roadway and the possibility of confusion during night driving and probable fog condition, an automatic amber flasher traffic signal will be installed in the nose of the dividing strip.

GRADE SEPARATION

The grade separation structure spanning the railroad track is of continuous flat slab construction resting on concrete bents with two expansion joints in the deck at the quarter points. The bridge is 425 feet in length, consisting of eleven 34-foot spans and two end spans each 25 feet 6 inches in length. The roadway width between curbs is 54 feet consisting of two 25-foot traffic lanes separated by a 4-foot dividing curb. A 2-foot 6-inch sidewalk is provided on each side of the bridge for pedestrian traffic.

After relocating the various public utilities which interfered with construction, constructing the detour and routing highway traffic over it, the next step was to start the excavation for the new railroad roadbed. This operation was so planned that work on the grade separation structure could be started immediately. The next order of work was to construct the southerly one-half of the structure, which portion spans the railroad track at its new location. When the southerly one-half was complete, the railroad realigned, and the new track placed in operation, it was then possible to construct the northerly one-half of the structure without interference from train traffic.

The work is being done in cooperation with the A. T. & S. F. Railroad. The railroad company is performing

Bay Bridge Terminal Dedicated Jan. 14, 1939

(Continued from page 8)

Dec. 21, 1936—First demolition of buildings for terminal site.

July 29, 1937—First shovelful of earth excavated for terminal site, southeast corner of Natoma and Fremont.

Nov. 29, 1937—First tie on bridge proper laid at Span E-22.

Jan. 12, 1938—First structural steel for terminal unit erected at First Street between Natoma and Minna Streets (12-foot steel columns).

Jan. 14, 1938—First major steel erected at Natoma and First Streets (43-foot steel girder).

Feb. 1, 1938—First spike for bridge railway placed at Span E-22.

Mar. 8, 1938—First steel for track level (third story) of Terminal Building erected at Fremont Street.

Sept. 23, 1938—First test train (Key System) ran from East Bridge head to Pier W-1.

Oct. 13, 1938—First test train of Interurban Electric (S. P.) on bridge.

Dec. 14, 1938—First train enters S. F. Terminal (Key System train) for signal tests.

Dec. 17, 1938—First Interurban Electric train enters S. F. Terminal from Oakland.

Dec. 20, 1938—Sacramento-Northern makes first test trip into San Francisco Terminal.

Jan. 5, 1939—Power turned on third rail.

Tests continue nightly until start of operation, January 15.

the work of relocating its track and is assuming the cost thereof. The railroad portion amounts to approximately \$125,000, and the State's portion, consisting of the construction of the overhead structure together with the cost of highway approaches, will cost approximately \$110,000. The State's portion is included in the Federal Aid Grade Separation Program and is being financed from Federal funds.

The excavation for the railroad location is being performed under contract by Sharp and Fellows of Los Angeles, and the construction of the grade separation and highway approaches is being performed under contract by the Union Paving Company of San Francisco. The contract date for completion is June 16, 1939.

STATE OF CALIFORNIA

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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FRANK W. CLARK-----Director

EDWARD J. NERON-----Deputy Director

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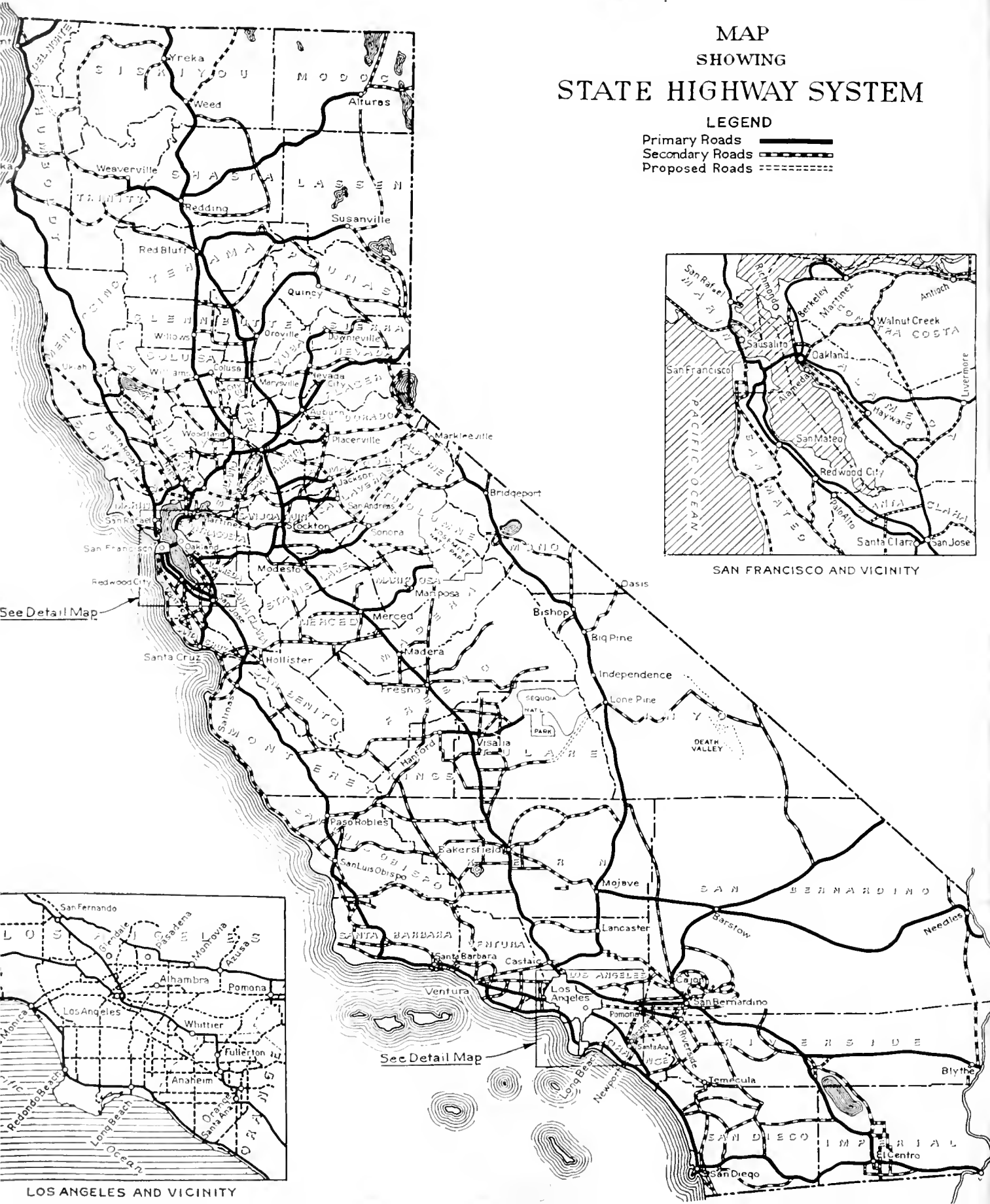
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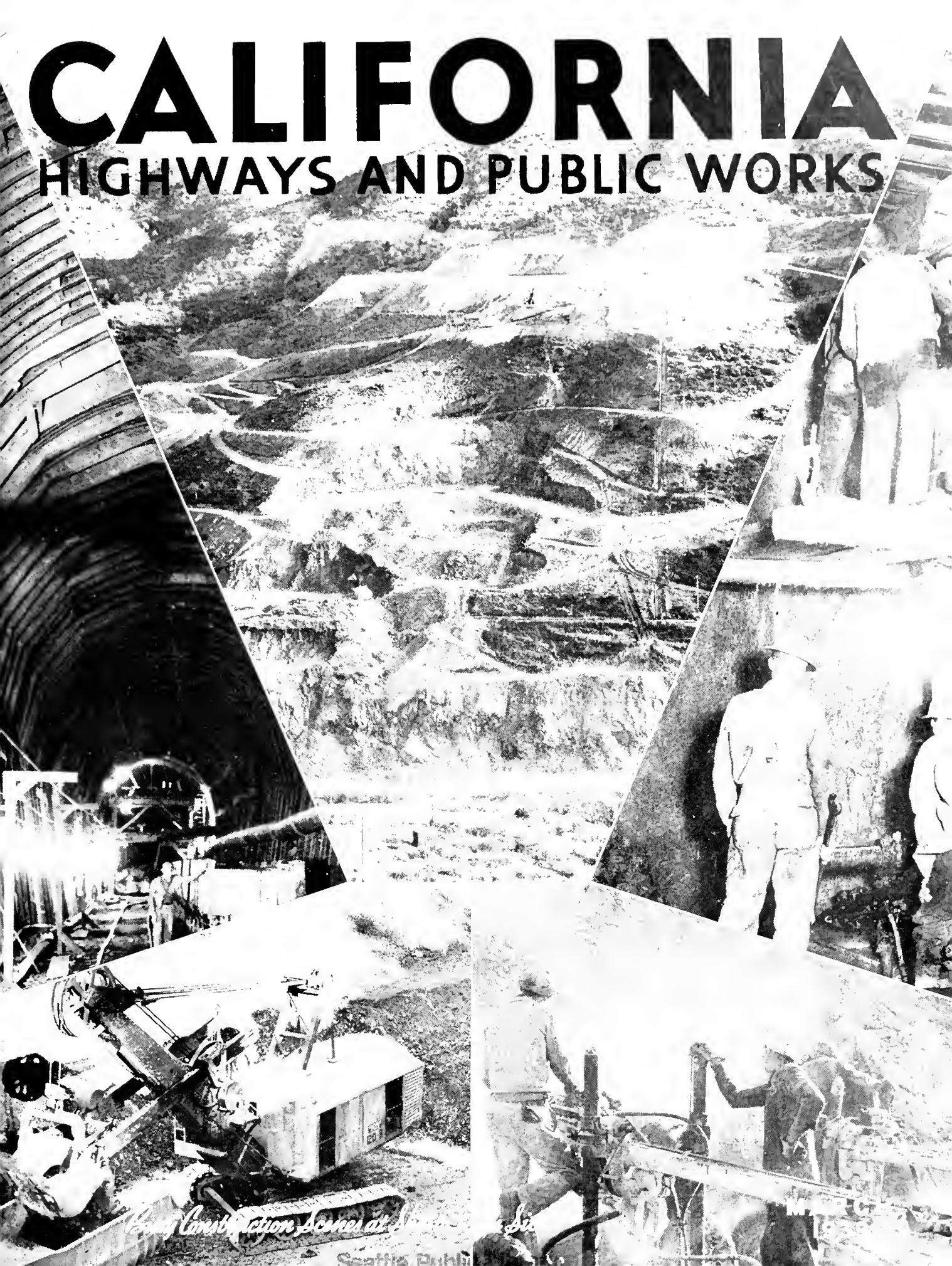
LEGEND

Primary Roads —————
Secondary Roads - - - - -
Proposed Roads
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CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



Public Construction Scenes at Various Sites

Seattle Public

MAY 1937

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

Published for information of the members of the department and the citizens of California

Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request

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MARCH, 1939

No. 3

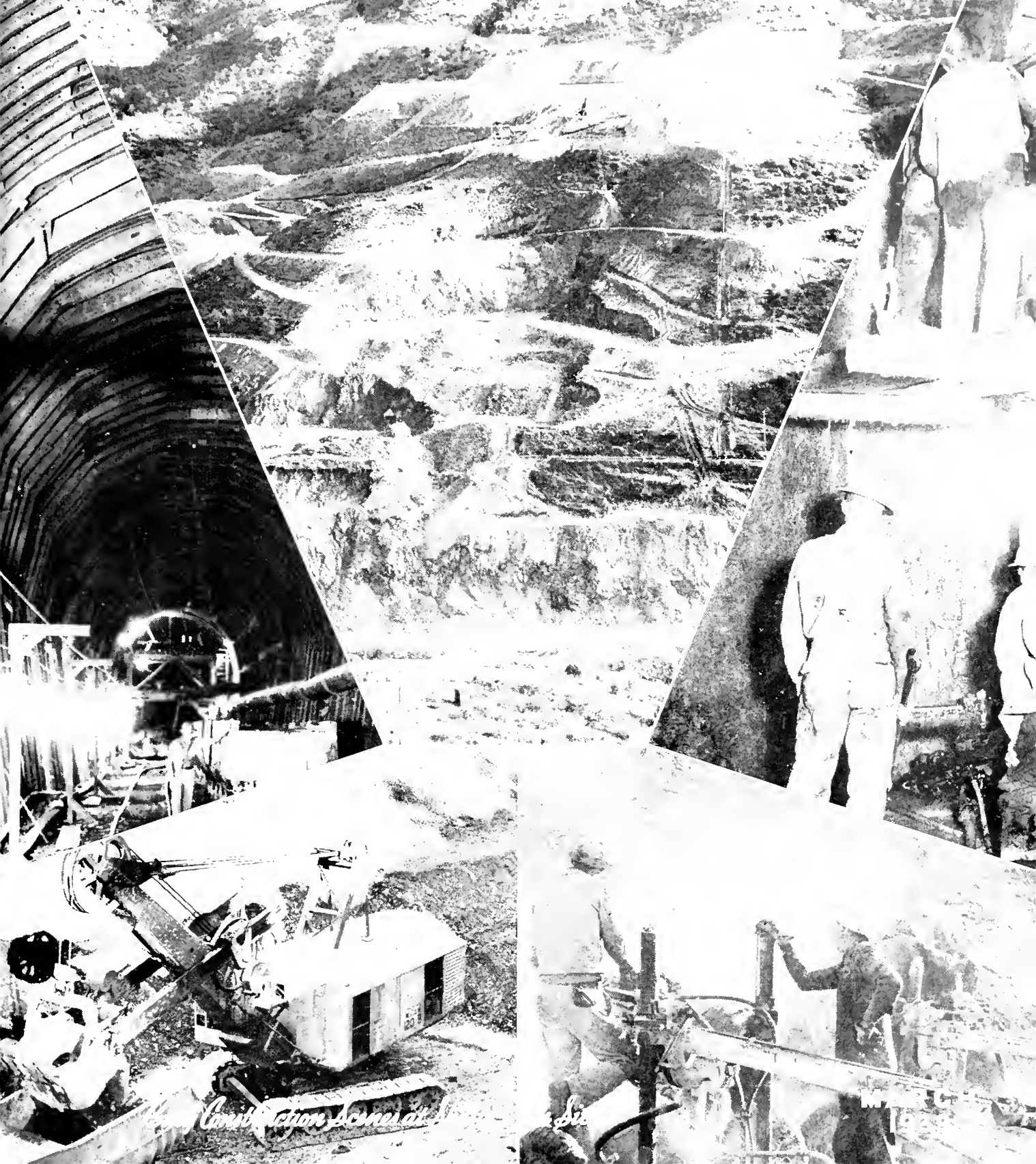
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CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



Construction Services at

San

1965

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Governor Olson Acts to Secure State Control and Operation of Shasta Water and Power

WITH characteristic energy and initiative, Governor Culbert L. Olson, signaling the launching of his comprehensive public ownership program, as outlined in his inaugural address, has within the last few weeks concentrated efforts to speed up construction of Central Valley Project.

His endeavors in this direction have met with highly encouraging success and promises of increased cooperation from the Federal Government.

"This great project," declares Governor Olson, "is the answer to over twenty years of untiring endeavors by the people of the Sacramento and San Joaquin valleys and upper San Francisco Bay region to secure a stabilized water supply. Primarily, the project is designed to provide for navigation improvement and flood control, and to furnish vitally needed water supplies for our present agricultural, municipal and industrial developments. But an important by-product will be hydro-electric power. The time has now arrived for the people to prepare plans for receiving and using the water and power to be made available, and these preparations should be started at once in order that the full benefits of the project upon completion may be realized without delay."

Early public distribution of power and water through the medium of the Central Valley Project is one of Governor Olson's most important if not his major governmental objective. Assuming the office of Chief Executive on January 2, Governor Olson lost no time in inaugurating the State Administration's public ownership movement.

At the first meeting of the new California Water Project Authority the Governor through Director of Public Works Frank W. Clark impressed upon the members of this governmental agency his predominant desire to hasten completion of the Central Valley Project and to place the State in a position to en-



GOVERNOR CULBERT L. OLSON

gage in public distribution of power and water at the earliest date.

In line with this policy, the Authority started consideration of a plan to construct at Antioch a steam-electric plant and transmission facilities therefrom, to furnish and distribute power prior to the bringing in of Shasta Dam power.

Governor Olson reiterated his wishes in this regard at the February meeting of the Governor's Council and coincidentally Director Clark announced he had asked the Legislature for a \$250,000 appropriation to be devoted to preliminary studies and surveys for the Antioch project.

At the Council meeting, the Governor also stated that Secretary of the Interior Harold L. Ickes and John C. Page, Commissioner of the U. S. Bureau of Reclamation, have expressed a desire to cooperate in every way with the State in the development, operation and maintenance of the Central Valley Project.

Director Clark revealed that the State will enter into negotiations with Washington for Federal aid for the Antioch project either in the form of a Reconstruction Finance Corporation loan or a P.W.A. grant or both. Director Clark added:

"The State would be justified in providing much more than \$250,000 for preliminary work on the Antioch project alone as it is directly in line with what the Reclamation Bureau desires us to do."

In his inaugural address delivered to the Senate and Assembly in joint session on January 2, Governor Olson said:

"The construction of the great Shasta Dam of the Central Valley Project was instituted as a Federal Government project. The Federal Government looks to this State and to its subdivisions to be prepared to receive the benefits of this project, not only in the equitable distribution of its water, but in the utilization of its hydro-electric power, through public agencies.

"Unless public agencies are pre-

pared with distributive facilities to receive such power upon the completion of this huge project, a monopolistic power trust would be the only entity ready to contract with the Federal Government for the distribution of this power, with the result that the people of this and future generations would be forced to pay unnecessary and exorbitant tolls. It shall be the purpose of this administration to promote the means for public ownership and operation of plants and distributive facilities for the distribution of this electric power for the people at cost."

In furtherance of this policy and his desire to hasten completion of the Central Valley Project, Governor Olson, Director of Public Works Clark, and State Engineer Edward Hyatt recently conferred in San Francisco with Secretary Ickes and Commissioner Page. The Governor submitted to these high Federal officials a program for increased participation by the State in the project. The Governor proposed:

GOVERNOR OLSON'S PROGRAM

1. That negotiations be initiated immediately between designated representatives of the U. S. Department of Interior and of the Water Project Authority of California on a contract between the United States and the Authority providing for (a) the administration, operation and maintenance of the Central Valley Project by the Water Project Authority, (b) the repayment of the reimbursable costs of the project by the Authority to the United States in accordance with the reclamation law, and (c) the securing of water and electric power contracts by the Authority with public and other agencies as security for repayment of reimbursable costs thereof, and execution of such contract at the earliest practicable date.

2. That the State by and through the Water Project Authority prepare plans and construct a steam-electric power plant in the vicinity of Antioch, Contra Costa County, together with the secondary transmission and distribution facilities necessary for the economic disposal of the electric power to public districts.

3. That the State direct and assist in the organization of public districts which will contract with the Water Project Authority for the

purchase of water and power and the enactment of necessary enabling legislation to carry out this program.

4. That the cost of the steam-electric power plant at Antioch and necessary transmission and distribution facilities therefrom be financed by and through the issuance of revenue bonds by the Water Project Authority under the provisions of the Central Valley Project Act coupled with a loan and grant of funds from the Federal Emergency Administration of Public Works, involving an estimated capital ex-



FRANK W. CLARK, Director of Public Works and Chairman of California Water Project Authority

penditure of approximately \$20,000,000.

5. That the United States Bureau of Reclamation expand and speed up its construction schedule for the Central Valley Project, so that the people of California will receive the benefit therefrom by the progressive completion of the entire project at the earliest possible date and early revenues may be obtained for repayment of funds advanced by the Federal government; and that Congressional appropriations for the project be increased for this purpose.

At his conference with Secretary Ickes, the Governor pointed out that

it would be economy to speed up construction. He said that developed lands will continue to be abandoned until water is delivered and that growth in load in the power market will be met by private utilities if the Central Valley Project power program is delayed.

He added that an enlarged construction program would materially help to solve California's serious unemployment problem.

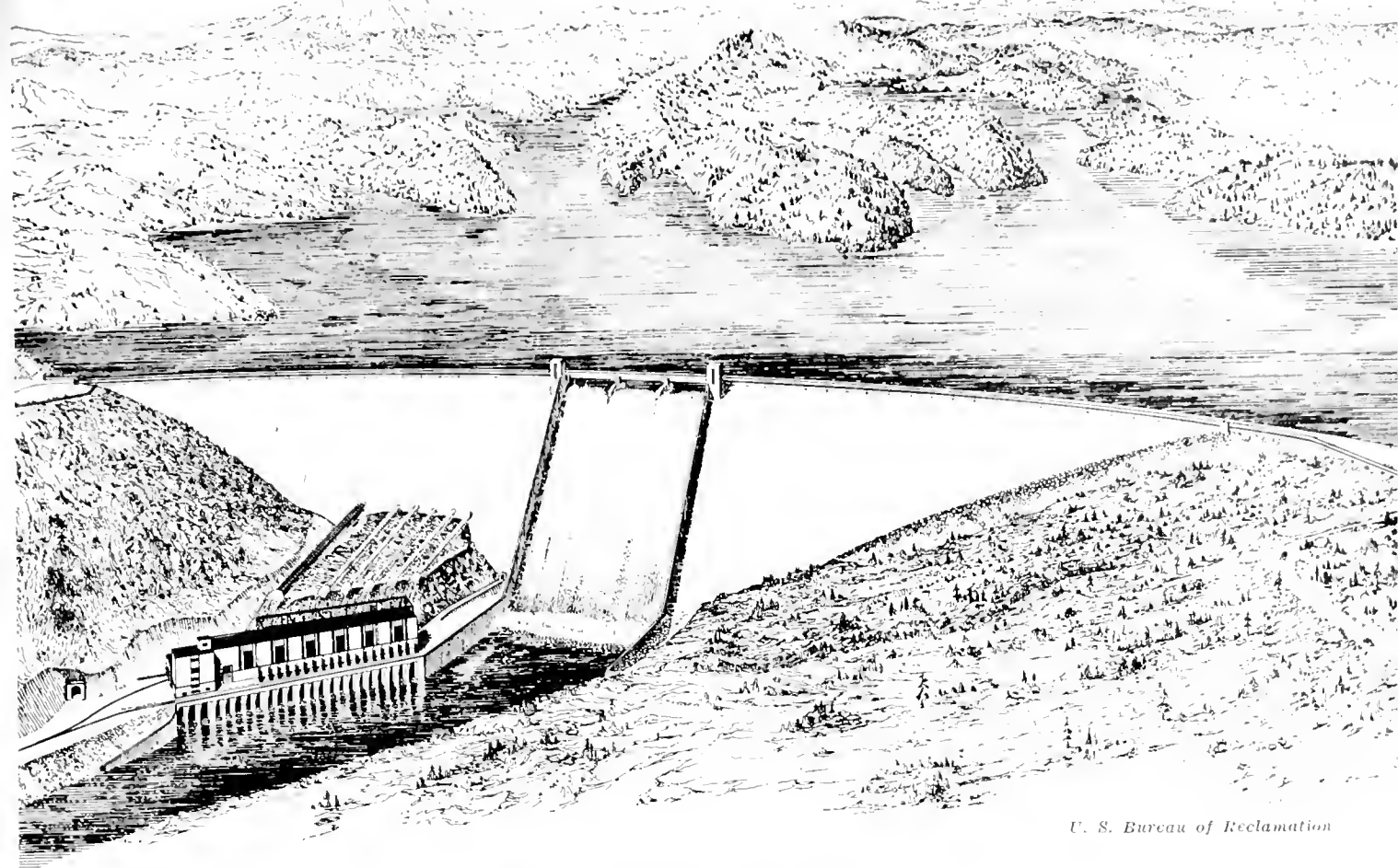
With regard to the disposal of electric power from the Shasta Dam power plant, Governor Olson told Secretary Ickes that he favors the formation of more public districts which would receive and with their own facilities distribute the power from the Central Valley Project to its own people at cost.

He expressed the view that if such public districts are not organized with their own distribution facilities, only one major customer for Central Valley Project power will exist: namely, the Pacific Gas and Electric Company. He said that preliminary organization of public districts should be undertaken as soon as possible.

In connection with the proposal to build a state-owned steam-electric power plant at Antioch, Governor Olson expressed to Secretary Ickes his opinion that the most advantageous and logical plan of procedure looking to disposal of Central Valley Project power to public districts would be to construct at an early date an initial installation of the steam-electric capacity to be required ultimately and a portion of the secondary transmission network and place the same in operation prior to the bringing in of Shasta power. This procedure, the Governor pointed out, would have the advantage of developing the market immediately for Shasta power, which could be initially served by the steam-electric plant and later by hydro-electric power from the project with the steam-electric plant providing the necessary auxiliary support and standby.

IMPORTANT ADVANTAGES

The Governor emphasized that the installation of a steam-electric plant as an initial unit of the electric power facilities of Central Valley Project would have a further important advantage in that it would provide the additional capacity required to meet the growth in load in the northern



U. S. Bureau of Reclamation

Official sketch of Shasta Dam Unit of Central Valley Project, showing the dam, power house, spillway and reservoir lake

California market prior to the bringing in of Shasta power, thus precluding any necessity for the installation of hydro-electric power plants such as proposed by the Pacific Gas and Electric Company on the Feather River in accordance with its application to the Federal Power Commission which is now pending and which is being protested by the Water Project Authority of California.

The Governor said that the construction of the steam-electric plant at Antioch would permit an interconnection with the Hetch Hetchy Project of the City of San Francisco which might hasten municipal distribution of electric power in that city.

As a means of strengthening Governor Olson's public ownership program, the State administration is sponsoring three bills introduced in the legislature amending or affecting the Central Valley Project Act. One measure amends the present act to authorize purchase as well as construction of facilities and provides a method of adding new units. The present law provides that new units may be added to the Central Valley



EDWARD HYATT, State Engineer and Executive Officer of California Water Project Authority

Project but does not set up a procedure for determining upon and including them. The proposed amendment supplies this procedure. Under the existing act, the State is empowered to construct the Central Valley Project but authority is not given to acquire existing facilities by purchase. This authority is added.

TAX PAYMENTS PROVIDED

Another amendment would change the present law by providing that a public agency distributing power may be required to pay equivalent sums in lieu of taxes. Under this amendment, political subdivisions would continue to receive the same amount of tax money as at present with electric power distributed by privately owned public utilities.

Other sections of the bill provide that the Water Project Authority, before constructing facilities, may call an advisory election in any given territory to ascertain whether the people desire public distribution of power; that the Water Project Authority may contract with any State agency for the acquisition of any works and may loan funds to such agency upon security and subject to such terms.

limitations and conditions as the Authority shall determine; limits the amount of revenue bonds which the Authority can issue for units and distribution facilities to such extent as may be determined upon after investigation and report; and revise the procedure for issuing revenue bonds based upon the procedure of the Federal Public Works Administration.

The second of the three measures introduced provides a more expeditious procedure for valuing public utility property for condemnation, and the third amends the Water Conservation District Act of 1923.

CENTRAL VALLEY PROJECT DESCRIBED

The Central Valley Project, to describe it briefly, provides for the coordinated development of the Sacramento and San Joaquin Rivers—

the two largest streams in the State—through a system of physical work to conserve, regulate and distribute the waters of these rivers in order to provide urgently needed water supplies for existing agricultural, industrial and municipal development in the San Joaquin and Sacramento Valleys and upper San Francisco Bay regions. It owes its inception to vital necessity. Its chief function is remedial. Its major objective is the preservation of present developments and production and the maintenance of a highly developed civilization threatened with serious loss and retrogression because of water shortage and inadequate conservation, control and distribution of the available water supply.

The area that will be served by the project, chiefly comprising the great Central valley of California, is about 500 miles long by 40 miles wide. Already highly developed, it contains over three million acres of irrigated land in production and supports a population of about a million inhabitants. It constitutes the heart of the State, both geographically and eco-

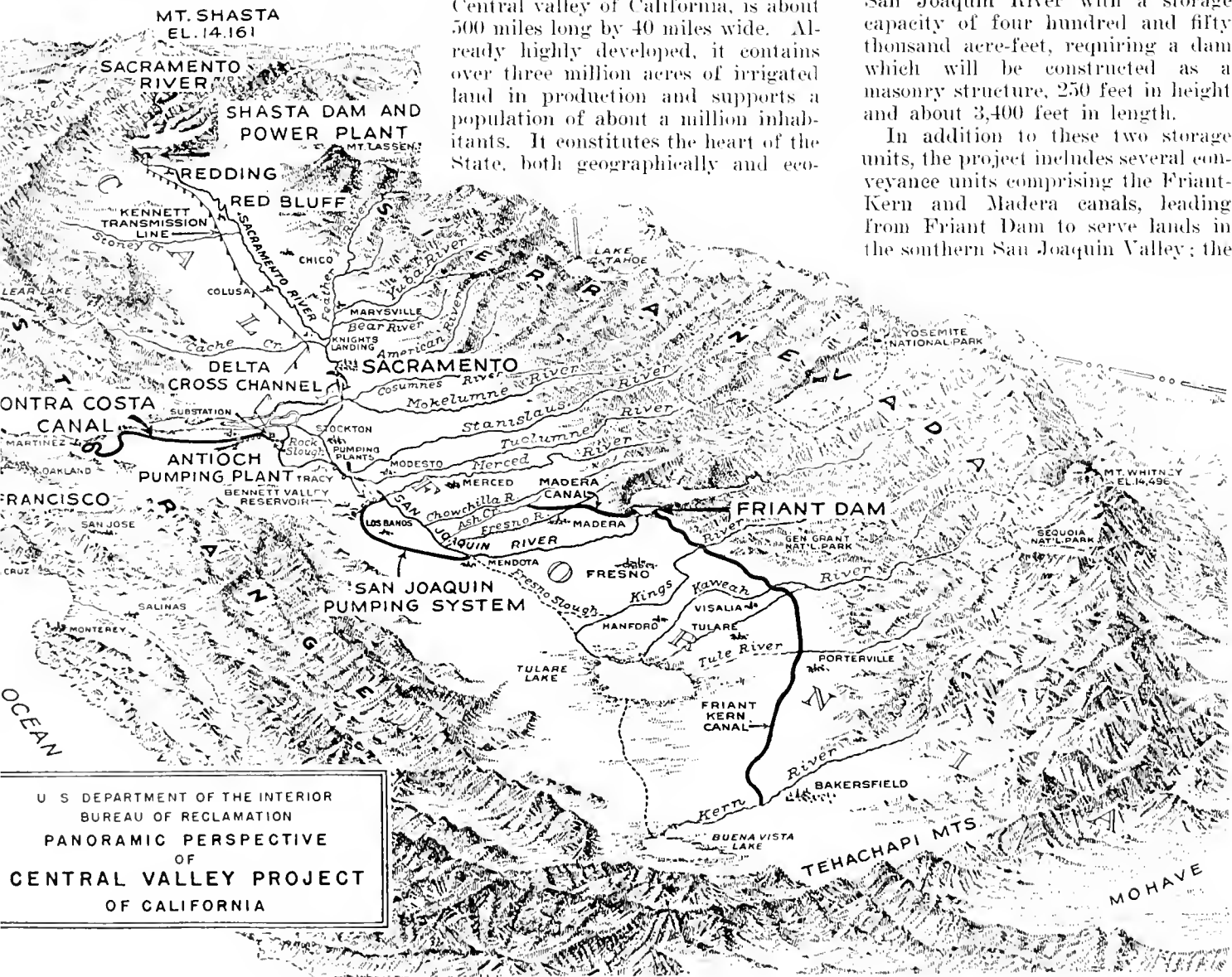
nomically. It is the "back country" of the metropolitan centers of San Francisco and Los Angeles which enjoy a trade valued at three-quarters of a billion annually on commodities moving to and from the Sacramento and San Joaquin Valleys.

SHASTA KEY UNIT

The key unit of the project is Shasta Dam and reservoir on the upper Sacramento River, so designated because practically all regulated water to be furnished by the project will be developed in this storage reservoir. It will have a capacity of four million five hundred thousand acre-feet. The dam will be a massive concrete masonry structure, rising to a height of 500 feet above stream bed.

A second storage unit—Friant Reservoir—will be constructed on the San Joaquin River with a storage capacity of four hundred and fifty thousand acre-feet, requiring a dam which will be constructed as a masonry structure, 250 feet in height and about 3,400 feet in length.

In addition to these two storage units, the project includes several conveyance units comprising the Friant-Kern and Madera canals, leading from Friant Dam to serve lands in the southern San Joaquin Valley; the





Excavating diversion channel at Shasta Dam site for Sacramento River, upper left. Shovel with 5-yard scoop filling 25-yard truck.

San Joaquin pumping system to carry water from the Delta into the San Joaquin Valley for use as a substitute supply for San Joaquin River water now used in the northern San Joaquin Valley; so that the waters of the San Joaquin River can be regulated in and diverted from Friant Reservoir; the Contra Costa conduit, conveying water from the Delta to serve a section of Contra Costa County; and the Delta cross channel to convey regulated water supplies from the Sacramento River across into the San Joaquin delta for use therein and diversion therefrom.

Plans for the Shasta Dam unit of the project also include an hydro-electric power plant with an installed capacity of over 500,000 H.P. at the Shasta Dam, which will be capable of generating one and one-

half billion kilowatt hours yearly on the average. Four units of this plant will be immediately installed with a combined capacity of 300,000 kilowatts. Contracts for the generating equipment have already been let. A main transmission line is planned extending 200 miles southerly from the dam to the vicinity of Antioch and a terminal substation to convey the electric power produced to the market.

SOLVES ALL URGENT PROBLEMS

The project when completed and placed in operation will meet all the urgent problems of water shortage and regulation in California's two great valleys. Crop losses due to dry year deficiencies in the Sacramento Valley will be eliminated. Commercial navigation on the Sacramento River will be restored. Additional

flood protection for lands bordering the upper Sacramento River will be provided. The invasion of salt water into the Delta channels, which for many years has resulted in large losses in crop production and menaced the continued productivity of the Delta land, will be prevented.

The existing deficiencies in available water supplies for industrial, municipal and irrigation uses in Contra Costa County will be fully met. The serious water shortage which has existed for many years and already caused abandonment and loss of between fifty and one hundred thousand acres of highly developed land in the southern San Joaquin Valley will be entirely overcome by the additional water supplies furnished through the canals extending from Friant Reservoir.

(Continued on page 28)

Repairing Flood Damage on All-Year Yosemite Highway

By M. C. FOSGATE, District Construction Engineer

A COMBINATION of warm weather and heavy precipitation in the high Sierra in December, 1937, changed what should have been snow to rain. Water falls that are usually practically dry at that season of the year began to feed into Yosemite Valley more water than has ever been known since the coming of the white man. The floor of the valley was flooded and considerable damage was done to roads and meadows.

The Yosemite drainage area is the main source of the Merced River and this combination of weather produced more runoff than the channel of the Merced should carry. The grade of the river is quite steep, falling 700 feet in 17 miles and the velocity of the water, which attained a maximum

depth of 30 feet in the narrower sections of the river, was very high.

The section of the all-year Yosemite Highway from Briceburg to El Portal, all of which lies on the banks of this river, was badly damaged, so badly, in fact, that for three days it was impassable. Before it could be reopened to traffic it was necessary to cut a new road into the bank in many places and in other places slides were bulldozed out to replace washed out fills. All of this work was of a temporary nature and as soon as surveys and plans could be made, a contract was advertised for replacing this section and protecting it against the recurrence of such major floods.

Originally this road was constructed by prison labor and no attempt was made to protect against

flood damage except in a few particularly bad places. At these locations rubble masonry walls were placed. These walls all stood the test of the flood and remained intact.

On the opposite side of the river from the highway the Yosemite Valley Railroad, the grade of which is practically the same elevation as the highway, suffered in like proportion and miles of its rails were pulled from the roadbed and literally tied in knots by the rushing water. This railroad has operated since 1907 and this is the first trouble of this kind that it had experienced.

HEWN OUT OF ROCK

The Merced River Canyon is very narrow with the walls of the canyon meeting the river's edge. The slopes



One section of Yosemite All-year Highway showing typical damage done by Merced River flood in 1937.



Yosemite All-year Highway damaged by flood waters of Merced River where State is building heavy rock wall to protect highway.



Section of rock wall flood protection being built on Yosemite Highway—Rock sizes from $\frac{1}{2}$ cubic foot and larger.

average about $1\frac{1}{4}$ to 1 so that in its original construction it was necessary to literally hew out the road, about 60 per cent of which was solid rock, the balance being mostly talus and disintegrated rock.

This road was first opened to traffic in 1926 and immediately became the main artery to Yosemite Valley and has remained so to the present time. Besides the traffic into the valley, there are several mines and one large logging camp which depend on this highway for transportation. Two school buses also use the road, one taking children to the elementary school at El Portal and the other taking high school students from the valley and way points to Mariposa.

For these reasons, it was necessary to reopen the road at the earliest possible time. To do this, traffic was first put under control between Briceburg and El Portal. Later a two-way road was obtained between El Portal and Indian Lodge and since then traffic has been under control between Indian Lodge and Briceburg.

The immediate repairs which were made by the Maintenance Department involved the expenditure of approximately \$3,650 for direct slide removal, \$68,900 for general repairs, \$5,807.32 for traffic control between Briceburg and Indian Lodge, and Federal funds in the amount of \$16,885 for general repairs.

A contract for repairs to this road was awarded to Mittry Brothers Construction Company on August 22, 1938, and on September 20, 1938, operations were started at the east-

erly end of the contract just east of El Portal. The work here consisted of a channel change and 1700 feet of rock embankment. About 200 feet of this embankment was placed where prior to the flood, a gasoline station had been located. All that remained of this station after the flood was a part of the concrete foundation for the gas pumps.

Control Schedule to May 30
From Briceburg

5-Week days	Saturday	Sunday and holidays
8.15 a.m.-----	8.15 a.m.	1.00 a.m.
10.00 a.m.-----	10.00 a.m.	8.15 a.m.
11.00 a.m.-----	11.00 a.m.	10.00 a.m.
3.00 p.m.-----	1.00 p.m.	11.00 a.m.
4.30 p.m.-----	2.00 p.m.	1.00 p.m.
	3.00 p.m.	3.00 p.m.
	4.30 p.m.	4.30 p.m.
	6.00 p.m.	6.00 p.m.

From Indian Lodge

5-Week days	Saturday	Sunday and holidays
7.45 a.m.-----	7.45 a.m.	7.45 a.m.
9.30 a.m.-----	9.30 a.m.	9.30 a.m.
10.30 a.m.-----	10.30 a.m.	10.30 a.m.
2.30 p.m.-----	12.30 p.m.	12.30 p.m.
4.00 p.m.-----	1.30 p.m.	2.30 p.m.
5.30 p.m.-----	2.30 p.m.	4.00 p.m.
	4.00 p.m.	5.30 p.m.
	5.30 p.m.	7.00 p.m.
	7.00 p.m.	

The work, in general, consists of replacing the road to its original condition which includes placing a base course of untreated crushed gravel, where the original was lost, and a penetration oil application with screenings for the wearing surface. The contractor is now erecting a crushing and screening plant for this

work. The major portion of the work, of course, is the protection against flood. This protection consists of three types, rubble masonry wall, rock riprap and rock embankment.

On February 15, 1939, the rubble masonry wall was 90 per cent complete, the riprap was 100 per cent complete, and the rock embankment was approximately 40 per cent complete. The rock embankment makes up the largest part of the protection work. Rubble masonry is placed where satisfactory foundations are available on the outside of the sharper turns of the river and adjacent to restricted river sections. Riprap, while not used extensively, found its place where suitable foundation was not available for walls and where restricted channel did not permit the use of rock embankment.

The rock embankments are being constructed approximately 12 feet wide and on a $1\frac{1}{4}$ to 1 slope. They are built of ledge rock sized from $\frac{1}{2}$ cubic foot to as large as can be handled by the equipment. At least 50 per cent must have a volume of $\frac{1}{3}$ cubic yard or more. This material is dumped over the end of the embankment from trucks and bulldozed into place, supplemented by cable and chokers operated by the power take off on the bulldozer to properly place the larger rocks.

The embankments are placed on foundations made by excavating down to large boulder formation. Where excavation is impractical on account

(Continued on page 19)

\$56,809,000 Cost to Modernize State Highways in District X

By R. E. PIERCE, District Engineer

HIGHWAY DISTRICT X, located as it is in the very center of California, with its headquarters at Stockton, and extending from tidewater on the upper reaches of San Pablo and Suisun bays and the Coast Range, across the great valley and over the high Sierra Nevadas to the eastern boundary of the State, has a wide variety of climate, soil and terrain.

Included within its boundaries are all of the following nine counties: Solano, San Joaquin, Amador, Alpine, Calaveras, Tuolumne, Mariposa, Stanislaus and Merced. Also included is the southern tip of Sacramento County below Walnut Grove.

There are thirty-two incorporated cities in District X.

The status of highways in District X is as follows:

- 54 miles, or 4.1 per cent unimproved roads and unoled earth roads.**
- 335 miles, or 25.6 per cent oiled earth roads inferior as to grade, alignment, width, drainage structures and carrying capacities.**
- 175 miles, or 13.5 per cent graveled road with light oiled surfaces expensive to maintain.**
- 205 miles, or 15.7 per cent intermediate improved type of surfacing.**
- 536 miles, or 41.1 per cent high type paving.**

The above 41.1 per cent of highways surfaced with high type paving, does not necessarily mean that they are adequate for present requirements. As a matter of fact, only a very small portion are adequate. On the main travelled routes, additional width is required and on other routes many miles are badly in need of improvement.

Of the above, 1305 miles are outside of incorporated areas, 7.2 miles

are State Park Roads, and 55 miles are inside incorporated municipalities. Of this municipal mileage, 37 miles are high type pavement.

The area served by District X roads includes most of the so-called "Delta" on the lower reaches of the San Joaquin and Sacramento rivers. This area is reputed to include some of the richest land in the world. The area is noted for the production of asparagus, celery and other truck produce. The counties of San Joaquin, Stanislaus and Merced are noted for their productivity, and are largely under irrigation. These conditions lead to the movement of large volumes of produce by truck into local packing or preserving plants; to the Port of Stockton, a recently opened deep water terminal, and to the San Francisco Bay area.

The foothill counties, Amador, Calaveras, Tuolumne and Mariposa, lie along the famous Mother Lode where mining activity has been greatly accelerated by the increased price of gold. This has increased the traffic over Route 65, the Mother Lode Highway and connecting highways.

The main traffic route in the district is Route 4, known as U. S. 99, extending for 102 miles north and south through the district. This route has a relatively heavy volume of traffic, with a maximum count exceeding 10,000 vehicles per day and averaging 6000 to 7000 vehicles per day.

The improvement of portions necessary to bring Route 4 to a four-lane divided highway using the existing pavement for two lanes, new bridges and drainage structures and grade separation structures will require an expenditure of \$6,500,000.

Route 5 (U. S. 50) with 71 miles in District X, extends from the San Francisco Bay area through Stock-

ton to the foothills near Mokelumne Hill, Route 65. From its junction with Route 66 at Mossdale, it carries the combined traffic from the north and south into the San Francisco Bay area. Route 66 is the main connection from Route 4 at Manteca to Route 5, and carries the through bay traffic from Route 4 to Route 5.

Another very important artery is Route 7 (U. S. 40) which forms a part of the main route between San Francisco and Sacramento, and extends north through Sacramento Valley to the Oregon State boundary, including forty-six miles through Solano and part of Napa counties. A much-used route is the Mother Lode Highway, extending from the north boundary of the district near Plymouth to Mariposa, county seat of Mariposa County, a distance of 105 miles. In the Mother Lode country are some of the richest and deepest gold mines of the United States. This route runs through the county seats of all four of the "foothill" counties, and forms a very necessary connection to the primary laterals connecting these county seats with Route 4. This road is only partly built to a satisfactory standard for the traffic it carries.

The West Side Highway, Route 41, extending from Route 5 near Tracy to the southern boundary of the district near Dos Palos, is also of importance to communities lying west of the San Joaquin River. This road was taken into the State System in 1933. This road is largely of narrow concrete pavement in poor condition and should be rebuilt.

The Sierra Nevada Mountains provide a wonderful summer vacation area, also winter sports are enjoyed at several points. The laterals in this area extend easterly from the Mother Lode Highway, the following crossing the summit of the Sierra Nevada:



Top—Underpass below tracks of Hetch Hetchy Railroad at Big Oak Flat, Tuolumne County, which is below legal clearance. Center—One-way road west of Coulterville in Mariposa County. Bottom—New Hope Landing bridge in San Joaquin County presents traffic hazards.

Route 23, Luther Pass Highway, highest elevation 7800 feet.

Route 34, Carson Pass Highway, highest elevation 8600 feet.

Route 24, Ebbetts Pass Highway, highest elevation 8800 feet.

Route 13, Sonora Pass Highway, highest elevation 9620 feet.

Route 40, Tioga Pass Highway, highest elevation 9940 feet.

Only a limited portion of the above are adequately built to reasonable standards.

In addition, Route 18, connecting with Route 40 at Carl Inn, known as the Big Oak Flat Road, enters the Yosemite Valley from the north. This part of Route 18 and all of Route 40 are of very low standard. Route 18 from Merced via Merced River Canyon is the "All Year Highway" into the Yosemite Valley, and also needs to be improved as to alignment and width.

The Carson Pass Highway and the Ebbetts Pass Highway, both lead into the Lake Tahoe area. The famous Calaveras Big Trees Grove, a State park, is on the Ebbetts Pass Highway.

Another very important lateral is Route 32, known as the Pacheco Pass Route, connecting Route 4 in the San Joaquin Valley with the San Francisco Bay area as well as the coastal area around Monterey and Santa Cruz. This road carries a heavy truck as well as passenger car traffic. On this route there are several narrow bridges in need of widening and several miles have narrow roadbed and shoulders needing reconstruction. Also, a large portion of alignment and grades are inadequate for present traffic.

District X's area of 11,900 square miles is 7.7 per cent of the entire area of the State. Its population of 265,000, according to the 1930 U. S. census, is 4.7 per cent of the State's total.

The motor vehicle registration in the District for 1937 was 115,300 automobiles and 10,600 trucks, or 5 per

Top—Obsolete road approaching Carson Hill on Mother Lode Highway in Calaveras County. Center—Narrow bridge over Mokelumne River, Mother Lode Highway, Amador County. Bottom—Bad approach to Mokelumne Bridge near Clements, San Joaquin County.

cent and 7.2 per cent, respectively, of the State's total registration during that period.

Auto traffic has a yearly total of 6,842½ million vehicle-miles in District X, which is 9.5 per cent of the total of 72,245 million vehicle-miles in the State.

The total mileage of the State highways in District X, including through incorporated cities and bridges is 1374, which is 10 per cent of the total State Highway mileage. Of the above mileage 363.5 miles are on the primary system and 1010.5 miles are on the secondary system. The primary system includes those highways that comprise portions of the original trunk highway system and connects the several county seats. The secondary system consists of other highways of the State Highway system. The terms "primary" and "secondary" as referred to the highway system has no reference to the type of surfacing or paving. It is quite possible for a secondary highway to be of higher type paving or surfacing than a primary highway.

There are 305 bridges in the district with a total length of 47,358 feet, or 9.0 miles. Thirteen of these bridges are of a movable span type over navigable streams or arms of San Pablo and Suisun bays and require twenty-eight bridge tenders or operators at all times. The total operation and maintenance cost of these movable span types of bridges amounts to \$60,000 per year. These thirteen movable span bridges in District X are more than the number of movable span bridges in all the other districts combined. In fact, these are 57 per cent of the total of twenty-three movable span bridges in the State highway system.

Two auto ferries, the only ones on the entire State Highway system, are operated across Cache Slough and Steamboat Slough, requiring eight ferrymen and an annual expenditure of \$17,000.

(Continued on page 26)





Recently completed underpass at Livingston, providing a four-lane divided highway beneath Southern Pacific tracks and eliminating a traffic hazard on U. S. 99.

Livingston Underpass Opened

WITH the official opening on February 21 of the \$265,000 underpass at Livingston, Merced County, the last but one of dangerous grade crossings on the Golden State Highway, U. S. 99, between Sacramento and Los Angeles, was eliminated.

The remaining traffic hazard on this route will be removed by a steel-beamed overpass across the Southern Pacific tracks south of Turlock, Stanislaus County. Contract for this improvement already has been let by the State.

Fred W. Panhorst, Bridge Engineer of the Division of Highways, who represented Governor Culbert L. Olson and Director of Public Works Frank W. Clark at the dedication of the Livingston underpass, called attention to the nearness of the highway safety goal on U. S. 99 toward which the Division of Highways has been moving over a period of years in addressing a crowd of 2,500 persons who attended the celebration

marking the formal opening of the Livingston improvement.

In this connection, District Highway Engineer R. E. Pierce announced at the ceremonies that two hazardous curves on the Golden State Highway at Delhi, scenes of numerous accidents, will be realigned this summer.

The Livingston project is 1.9 miles in length and consists of an underpass with a four-lane divided roadway, and realignment of the adjacent highway.

The depressed portion of the underpass is 2000 feet long, there being two 24-foot roadways separated by a 7-foot dividing strip with curbs. Two 3-foot sidewalks provide for pedestrian travel. The cut slopes are paved with concrete.

The overhead structure carrying one track of the Southern Pacific Railroad consists of two steel plate girders each 117 feet 6 inches long, resting on reinforced concrete U-type abutments and a center pier, all supported on timber piles. The center

pier is located between the divided highway lanes.

During construction of the abutments and superstructure, the railroad traffic was routed over a shoo-fly track located about 70 feet away from the permanent track.

Preliminary investigation showed that ground water could be expected to rise to within 16 feet of the rails, whereas the roadway surface at the lowest point is 20 feet below the rails.

In order to provide for the uplifting action of this ground water, the pavement was thickened to a maximum of 3 feet at the low point of the depressed portion. Also along the pavement there is a system of drainage pipes which intercept any excess water and carry it to a sump where it is then pumped into a discharge line. All rainwater which falls within the underpass area is intercepted by catch basins and carried to this same sump.

All water intercepted by the sump is pumped into the discharge line by means of two pumps each capable of

delivering 1000 gallons of water per minute.

Some difficulty was encountered in constructing the sump due to the ground water and behavior of the fine wet sand, which was very compact and resisted the driving of cofferdam piles. The bottom of the sump is 16 feet below the roadway surface.

It was necessary to construct facilities for handling water in an irrigation canal which intersects the depressed portion of the underpass. This was accomplished by constructing an inverted syphon having an invert 17½ feet below the normal grade of the canal, and 9 feet below the roadway surface.

The new highway skirts the town of Livingston. A connection to it was constructed from the town so that traffic entering Livingston from the north will not have to cross the railroad tracks at grade. During construction this connecting road served as a detour.

The new roadway pavement is of reinforced concrete, varying from 23 feet in width to the divided four-lane section. The divided highway is 3000 feet long and is constructed to tie in

with future developments of the adjacent two-lane roadway.

At each end of the dividing strip curb, there is a concrete nose in which an amber flasher light and three ruby reflectors have been placed to warn traffic that it is entering the divided highway. These devices have been supplemented by suitable reflectorized signs.

Addresses, daylight fireworks and selections by the bands of the Livingston High School and the Livingston elementary schools highlighted the dedicatory exercises, which were opened by Warren E. McConnell. With E. G. Adams acting as chairman, short talks were made by Mayor J. B. Lyon, District Highway Engineer Pierce and Mr. Panhorst.

Mr. Panhorst in his address said that press of official business had prevented Director of Public Works Clark from attending the dedication but that the director had sent the following message touching upon features of Governor Olson's State administration program:

"In public utterances, Governor Olson has pledged his administration to work for a reduction of unemploy-

ment, a decent standard of living for all, opportunities for youth, social security, old age retirement and kindred public welfare goals. He has promised that any effort to extend a corrupting tentacle into any department of our State government would be vigorously opposed and those responsible punished.

"He has said that the courageous endeavors of the farmers of California in meeting their problems shall receive every deserving service within the power of his administration to render.

"I take the liberty of quoting from the Governor's inaugural address. The Governor said:

"Let me assure all business men and business organizations that in their transactions with the State they need neither political pull nor political lobbyists in order to obtain a fair hearing and a fair and square deal under the law. Legitimate business, concerned only in honest and efficient administration of the law will have the whole hearted support of my administration."

On the speakers' platform were: Jack Kaufman of Merced, secretary

(Continued on page 19)



Scene at opening of Livingston underpass when large crowd surrounded speakers' stand filling new four-lane approach road.

Prado Dam Project Compels Relocation in Santa Ana Canyon

By A. EVERETT SMITH, Assistant Highway Engineer

THE old route of the Santa Ana Canyon Highway lying between the Orange County line and Corona passes through the reservoir site of the proposed Prado Dam. The Prado Dam project has been studied by Federal engineers for a number of years, and the relocation of the highway has necessarily been delayed, pending the outcome of the final working out of the Prado Dam plans by the Federal Government.

This is a portion of State Highway Sign Route 18 which serves the populous beach communities in going to

congestion causes extreme hazard where poor alignment and gradient are involved.

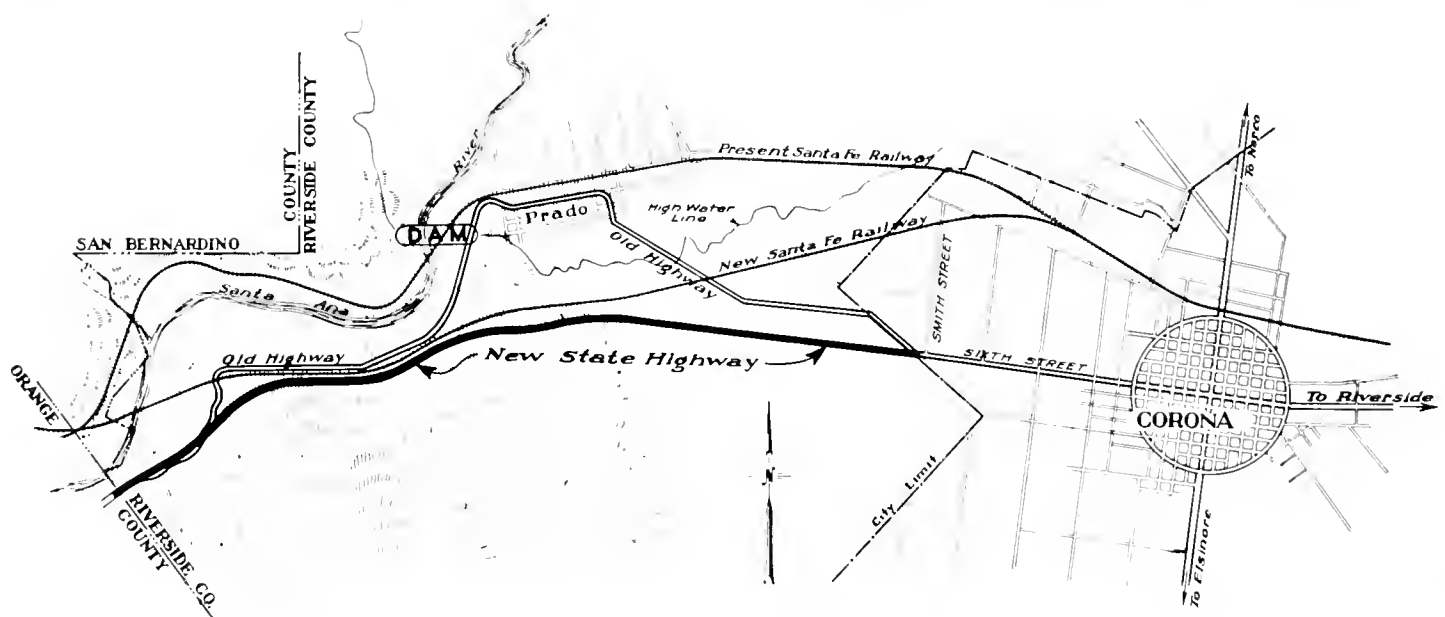
Before this unit of highway could be improved, it was necessary to have definite information as to the location of the dam and the subsequent resulting high water elevation. Due to the location chosen for the dam, the limits of the ultimate lake established by the high water line covers a portion of the existing State highway and Santa Fe Railway.

With the establishment of the location of the dam and the resultant

work has been completed with the exception of placing the surfacing.

On January 10 of this year the Division of Highways awarded a contract to V. R. Dennis Construction Company for the construction of a highway on new location from the Orange County line easterly to Corona. The construction under this project will be to modern standards. The minimum radius of curvature is 1500 feet and the maximum gradient is 3.18 per cent.

All of the project excepting the westerly 0.6 of a mile is to be con-



the mountain resorts of Southern California. People of the inland cities of Riverside and San Bernardino counties also use this route to go to the beaches. There is additional heavy truck and passenger traffic from the Los Angeles Harbor District to inland points in Southern California and to Arizona and Nevada.

As is common with pleasure bound traffic, peak volumes occur on weekends and holidays. The resultant

high water line, steps were taken to relocate the railway and highway facilities.

In August, 1938, a contract was awarded by the Orange County Flood Control District for a project about 1.5 miles in length. The State participated in this project and it embraced placing drainage structures and grading a roadway to a rough grade section for the combined use of the railway and the highway. This

structed to a 68-foot roadbed section on a minimum right of way width of 200 feet. This 68-foot roadbed is designed for a future four-lane highway with a central divisional strip.

In addition to grading, drainage structures are to be placed and the project surfaced throughout, including the portion, previously referred to, that was constructed by the Orange County Flood Control District.

(Continued on page 27)



View of excavation operations under way at Prado Dam site on Santa Ana River compelling relocation of the State highway and the railroad tracks seen in foreground of picture.



A portion of the new highway, grading of which was recently completed. It is located in a more attractive rolling country higher above the river.



Section of recently completed Sepulveda Boulevard unit where it passes the lower San Fernando reservoir of the L. A. water system.

New Sepulveda Link Opened

By RALPH C. MYERS, Assistant District Office Engineer

THE formal acceptance by the State on November 30, 1938, of the 3.66-mile paving contract connecting San Fernando Road, just northerly of San Fernando, with Brand Boulevard, marked the opening to through traffic of a direct route (via Sepulveda Boulevard) between the Ridge Route Alternate and the Los Angeles Harbor and west coast beach cities, including the communities of Santa Monica, Ocean Park, Venice, El Segundo, Manhattan Beach, Hermosa Beach, Redondo Beach, Long Beach, and points southerly.

Traffic from the San Joaquin Valley formerly was required to pass through downtown Los Angeles or the congested Hollywood district in order to reach the harbor or West Los Angeles and the beach cities. Now it can use Sepulveda Boulevard,

which passes in nearly a direct line southerly from San Fernando Road at the "Cascades" across the Santa Monica range of mountains and through West Los Angeles to a junction with the Roosevelt Highway at the Los Angeles Municipal Airport at Mines Field.

The length of this route is about 30 miles, and it passes through the less densely populated areas of Los Angeles and Culver City, making it an ideal high-speed, direct north-and-south highway along the west side of the Los Angeles metropolitan area.

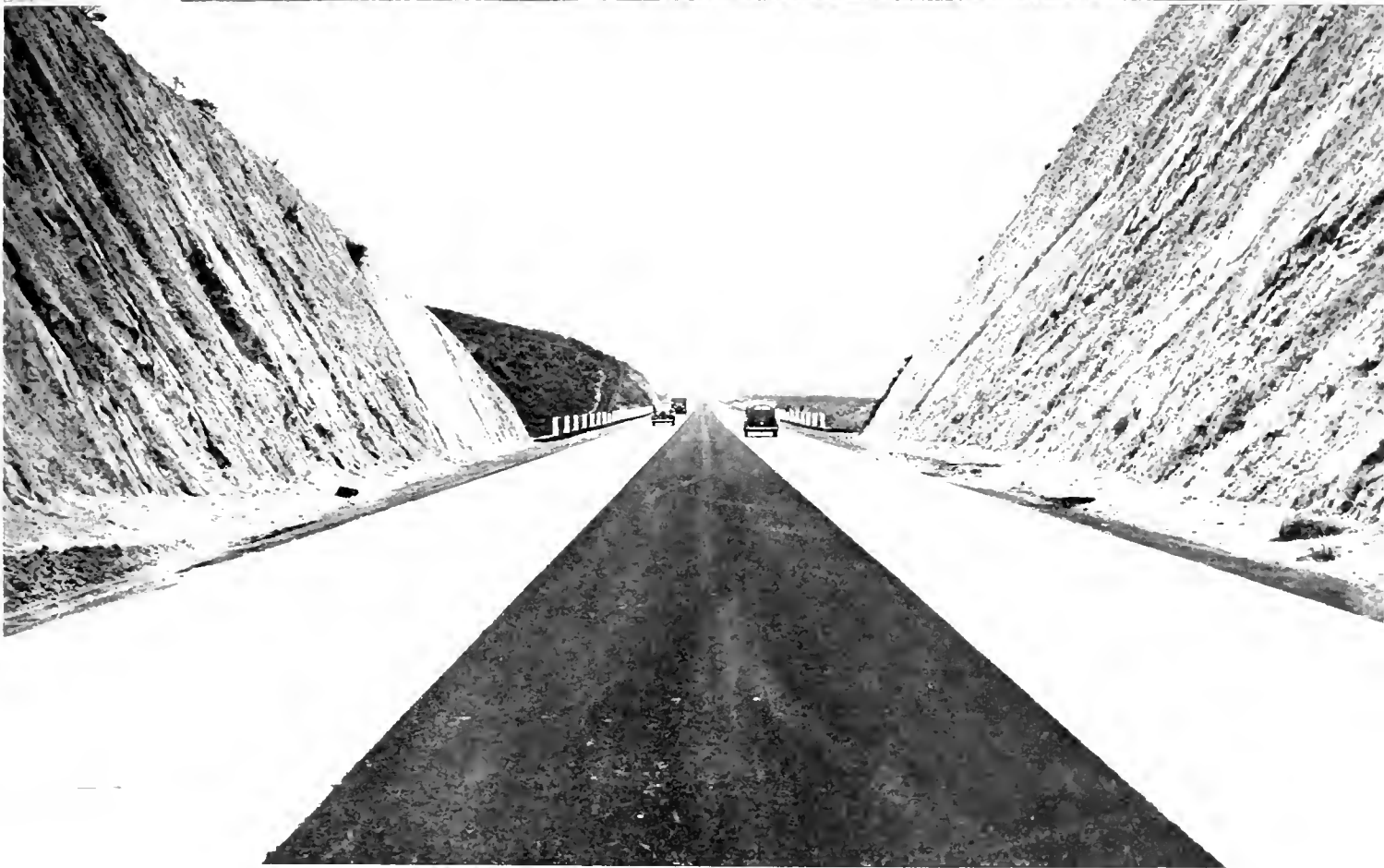
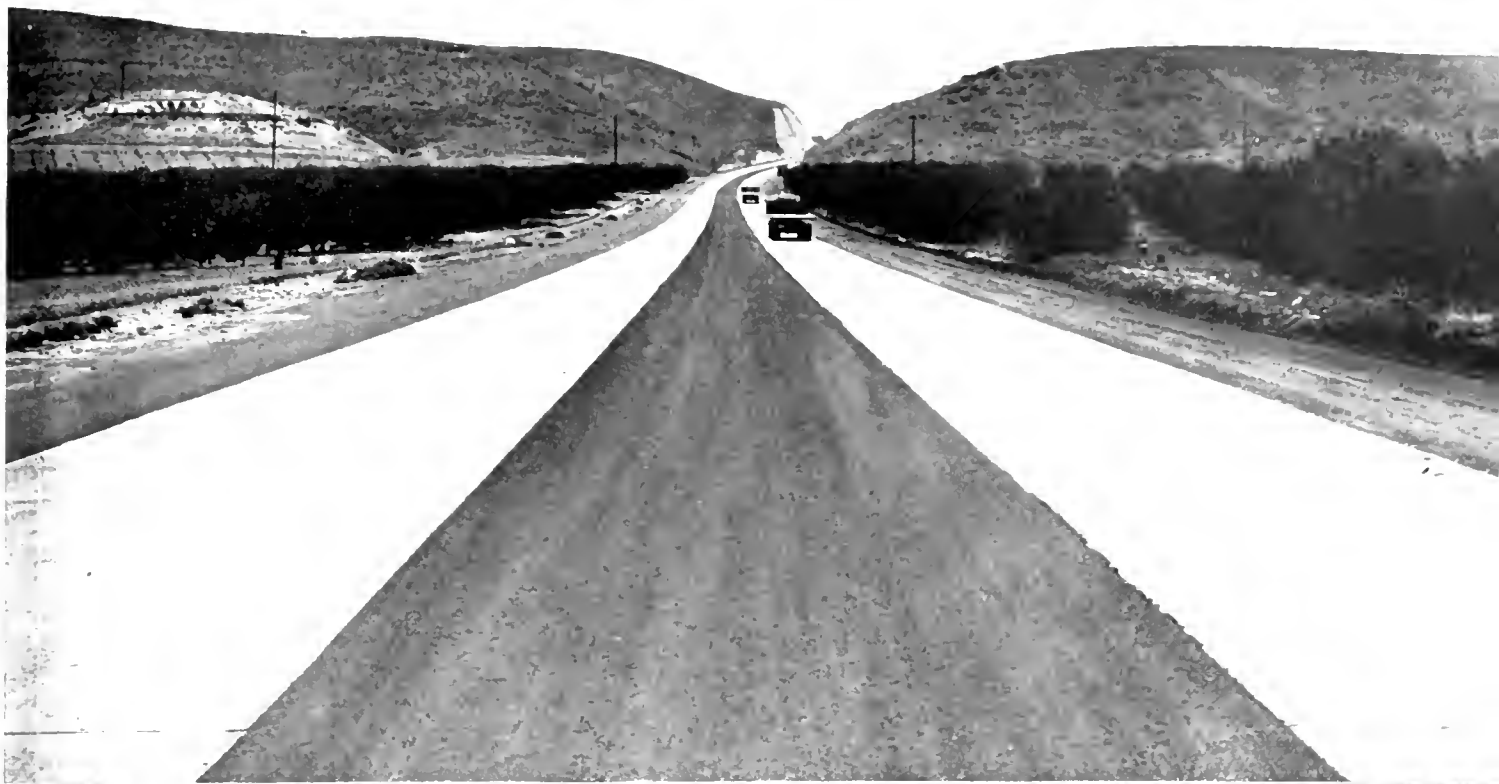
BY-PASSES SAN FERNANDO

The project leaves San Fernando Road near the "Cascades" of the Los Angeles Aqueduct about $1\frac{1}{2}$ miles northwest of the city of San Fernando and extends in general in a southerly direction through rolling country

along the easterly edge of the San Fernando Reservoir and just westerly of San Fernando Mission, connecting with Brand Boulevard, which, in turn, furnishes a direct connection to the West Los Angeles area.

The paving contract on San Fernando Road and Brand Boulevard was completed during 1938 by Matich Bros., Contractors, and was accepted by the Director of Public Works November 30, 1938.

This section was graded to a 40-foot width of roadbed in 1936 under a State contract with Griffith Company, but the placing of pavement was deferred until the necessary funds became available. Surveys and plans for grading this portion were handled by the engineering department of the city of Los Angeles, but the actual grading work was handled by State contract, financed



These two pictures of portions of the recently completed sector of the Sepulveda route from San Fernando through the Santa Monica Mountains to the coast in Los Angeles County show its direct alignment and ample width of roadway. There are only three slight curves in the 3.66 miles of the improvement. Two outside lanes of portland cement concrete pavement are 11 feet wide and separated by a center passing lane of plant mixed surfacing also 11 feet in width.

by U. S. Works Program highways funds.

GRADED BY HAND LABOR

Federal requirements in connection with grading this section provided that grading work be done by hand labor methods. About 350,000 cubic yards of roadway excavation were removed in this manner at a cost of \$488,613.72. The project afforded employment amounting to 486,316 man-hours of labor.

Plans for the paving work were prepared by the city of Los Angeles early in 1938, and a State contract for this work was awarded and work started August 15, 1938.

This portion of Sepulveda Boulevard has been constructed on almost a direct line, there being but three slight curves in the length of 3.66 miles having radii of 1555 feet, 2000 feet and 6700 feet, respectively. Two outside lanes of portland cement concrete pavement have been placed each 11 feet wide as compared with former standard width of 10 feet. The two portland cement concrete pavement lanes are separated by a center passing lane of plant-mixed surfacing which is likewise 11 feet in width. Alignment, grades and pavement all conform to the latest State highway standards of construction.

STAGE CONSTRUCTION PROJECT

Since the Sepulveda Boulevard route was taken into the State Highway System in 1933, several State and city contracts have been completed covering various portions of the route between San Fernando Road and the connection with the Coast or Roosevelt Highway at Mines Field.

The southerly end of the route, from Lincoln Boulevard to Centinela Avenue was graded to a 74-foot width roadbed, constructed on a 100-foot right of way with 40-foot portland cement concrete pavement and wide oiled shoulders, during 1936 and 1937. This section which is 3.1 miles in length was constructed under State contract at a total cost of \$222,235.90.

Another State contract, the 1.6-mile section from Playa Street to Washington Boulevard, was constructed to a width of 74 feet between curbs with a 30-foot portland cement concrete pavement, during 1937 at a cost of \$102,057.58.

A Los Angeles City contract for the 2.1 mile section between Pico Boulevard and Venice Boulevard



under which the city handled the grading and placing of a 40-foot portland cement concrete pavement was completed September 6, 1935, at a cost of \$144,353.33.

THROUGH SANTA MONICA RANGE

Another Los Angeles City contract for the section between Sunset Boulevard and Ventura Boulevard was completed October 29, 1935. This is the section extending through the Santa Monica range of mountains and was improved by the city under a cooperative financing agreement with the State. The work consisted of grading and placing 7.7 miles of 30-foot asphaltic concrete pavement at a total cost of \$300,580.37.

The total amount expended under

city contracts to date is \$444,933.70. Under the three State contracts which have been completed, \$923,113.95 has been expended, making a total of \$1,368,047.65 expended on this route under city and State contracts since it was taken into the State Highway System in 1933.

Although the route is now traversable from one end to the other, there are a number of improvements yet to be made to bring it for its full length up to modern requisite standards of width, alignment, and grade.

ARRANGING DRAINAGE PLAN

A short section of the route between Centinela Avenue and Washington Boulevard, 0.7 mile in length,

(Continued on page 26)

Repairing All-Year Highway Into Yosemite

(Continued from page 8)

of large boulders on the surface, hand work is resorted to. After all earth or sand is removed from these rock surfaces and all small or loose rock is removed, a rock toe wall is constructed as a base for the rock embankment. This toe wall is later grouted to the rock it rests on and to the lower portion of the rock embankment.

As it is believed necessary to keep the face of the embankments as smooth as possible on its surface, it is specified that the outer surface shall not vary more than one foot from the planned slopes. For this reason, it is necessary to follow up the placing of the embankment with a crane, taking off and adding on until as true a surface is obtained as possible. Ledge rock for this work is obtained by widening cuts and by so doing it is possible in most instances to eliminate protection work at these locations.

The approximate quantities of the major items of this contract are:

Rubble masonry, cubic yards.....	11,450
Rock embankment, cubic yards.....	101,317
Roadway excavation, cubic yards.....	233,630
Structure, ditch, channel and trench excavation, cubic yards.....	64,353
Untreated crushed gravel, tons.....	18,750

The total contract items, amount to approximately \$605,529. With a completion date of July 1, 1939.

It is anticipated that in the spring, as soon as the present contract has progressed to a point where it is possible to start surfacing, a contract for plant-mix surfacing for the project will be advertised in an attempt to complete as much of the road as possible before vacation travel starts.

A. N. Lund is Resident Engineer on the contract.

"Do those Englishmen understand American slang?"

"Some of them do. Why do you ask?"

"My daughter is to be married in London to an earl and he has just cabled me to come across."

"I think," said the wife, "that men should wear something to show that they are married."

"Well," replied the husband, "what about their shiny snits?"—*Vancouver Province.*

Motorist Praises Courteous Help on Bay Bridge

February 20, 1939.

California Highways and Public Works, Sacramento, Calif.

While driving to the exposition on Treasure Island yesterday afternoon I had the misfortune to have a blowout while on the Bay Bridge between Yerba Buena Island and Oakland.

On stopping the car, a motorcycle patrol asked if we wanted any help, and then sent for a repair car.

The tire was changed in a few minutes and we continued on our way.

I want to commend whoever is responsible for the courtesy received from the patrol, and the repair men, and also for the very nominal charge made for the service to the car.

Very truly yours,

CARLETON A. CURTIS,
San Francisco.

Livingston Underpass Opened

(Continued from page 13)

of the Merced Chamber of Commerce; Mayor Roy M. Day of Turlock; Desk Officer David C. Peters of the Turlock Police Department; City Councilman Ralph Fay of Stockton; Supervisor Don Castile of Merced County; City Attorney Hugh Griswold of Merced; John R. Graham of Merced; Corwin Radcliffe, Merced; Livingston City Councilmen John Groom, F. M. Ecclefield, and Roy W. Crowell; A. E. Todhunter, president of the Livingston Chamber of Commerce; and C. R. Davis and Robert Lee, members of the committee of arrangements.

Following the speech making program an official cut a ribbon stretched across the southerly approach to the underpass and officially declared the highway open. Six

Governor Olson Names Highway Commissioners

REORGANIZATION of the California Highway Commission was effected by Governor Culbert L. Olson on March 3.

The Governor named four new members of the commission on that date and later appointed a new secretary.

In announcing his selections, the Governor said he will appoint a fifth member to succeed Director of Public Works Frank W. Clark, who has been acting as a highway commissioner under temporary appointment.

Larry Barrett of San Francisco succeeds H. R. Judah of Santa Cruz as chairman and on the board with him are Bert L. Vaughn, San Diego and Imperial County hotelman; Amerigo Bozzani, Los Angeles automobile dealer and president of the Italian-American Society, and Jener W. Nielsen, Fresno attorney and business man.

Former Congressman Byron N. Scott of Long Beach was named secretary.

Governor Olson announced that he is of the opinion the commission should be increased from five to eleven members in order to give all sections of the State more adequate representation. In view of the fact that highway commissioners receive no salary, the Governor said he believes the commission's membership can be enlarged without materially adding to the cost of administration of that agency.

Little Livingston girls held the ribbon. They were La Verne Roy, Doris Lee, Ella Mae Gant, Bonnie June Ulrich, Mary Ellen Magnuson and Dorris Nobbe.

The Livingston project was financed from Federal Aid Grade Separation Funds except for the portions lying outside the 1500-foot limit, which were financed from the State Highway Fund and regular Federal Aid.

The contractor on this project was Louis Biasotti and Son, of Stockton.

All track work was performed by the Southern Pacific Railroad Company.



View of highway grade separation and divisional islands at intersection of Routes 75 and 206 near Broadway Tunnel in Oakland.

New Channelization Features

By F. M. CARTER, Assistant Maintenance Engineer

THE city of Oakland, California, has utilized a definite channel construction to permit traffic to flow through an intersection that previous to the channelization presented distinct hazards through the numerous movements of traffic. This intersection is just west of the Broadway low-level tunnel, Broadway, State Highway 75 and Landvale Street, State Highway 206.

This design of channelization was the result of the cooperative efforts of the city of Oakland and the State Division of Highways. The intersection originally was a grade separation. With the construction of the Broadway low-level tunnel, the traffic was materially increased and it be-

came necessary to channelize. The work was done under the supervision of City Engineer Walter N. Frickstad, of Oakland.

Assuming that driving accidents are not premeditated acts, but are caused when something unexpected or unlooked for occurs, definite traffic grooves or channels like railroad tracks should reduce the points of unexpectedness and permit the driver to confine his attention to certain definite points of interception.

In the construction of channels to pass traffic through an intersection, the straight through and the right-turn traffic is readily handled. The problem is the traffic turning left. A driver of a vehicle may be expected

to take the easiest and simplest course. A left turn, taking short cuts at an unchanneled intersection, presents the unexpected and confuses the driver of the vehicle passing through the intersection in the proper lane. It is possible, of course, that the straight through or the right turn may take a course that would create an unlooked for condition.

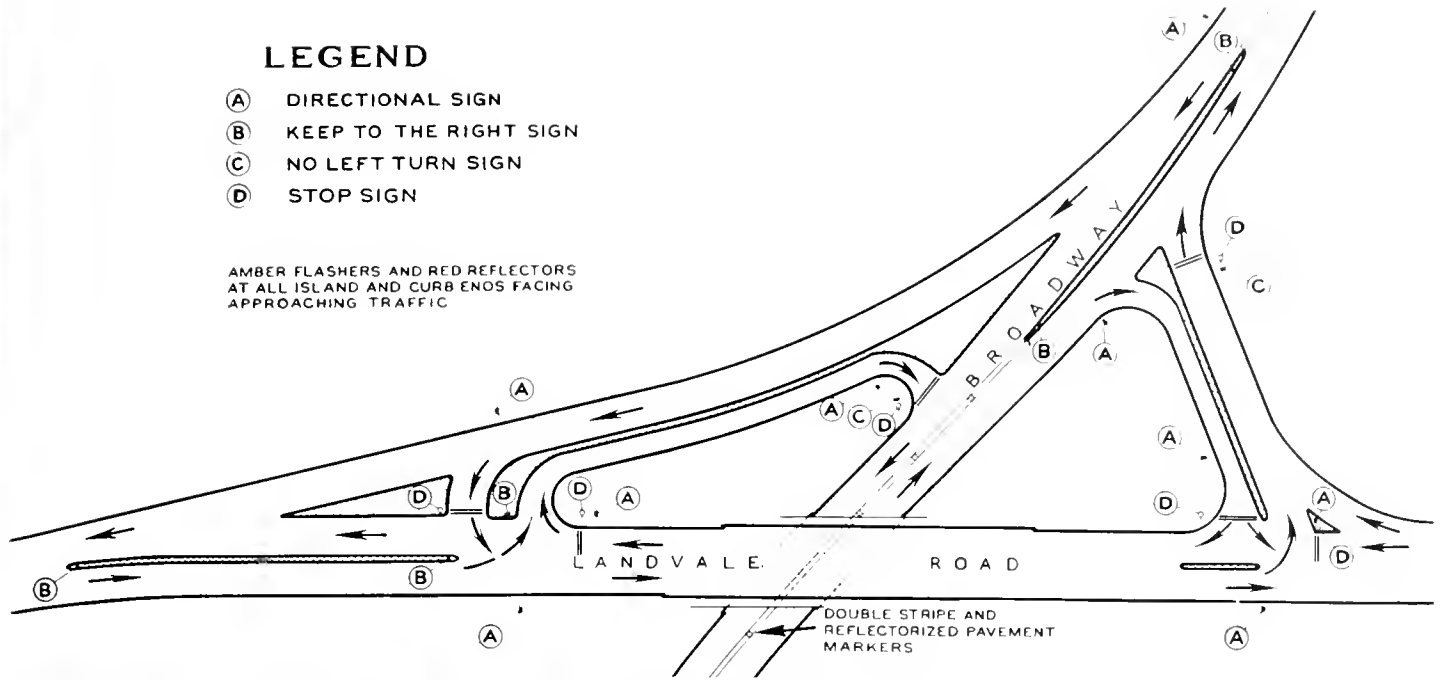
The treatment now commonly applied to overcome these unexpected turns of traffic is to take some means to keep traffic in the proper channels in each direction and to adjust the channels so that traffic will intersect as nearly as practicable at a right

(Continued on page 27)

LEGEND

- (A) DIRECTIONAL SIGN
- (B) KEEP TO THE RIGHT SIGN
- (C) NO LEFT TURN SIGN
- (D) STOP SIGN

AMBER FLASHERS AND RED REFLECTORS
AT ALL ISLAND AND CURB ENDS FACING
APPROACHING TRAFFIC



Plan of traffic channelization and separated grade intersection of two heavy traffic highways where only partial clover leaf connections are possible.



Another view of the channelization islands and continuous dividing strip at the intersection entrance to Landvale Road.

New Bridge Superstructure Placed by Skidding Operation

By O. T. ILLERICH, Associate Bridge Design Engineer

AN INTERESTING method was utilized in the reconstruction of the Bridges Creek bridge located at the heel of a horseshoe bend of the scenic Redwood Highway, State Highway No. 1, through the rugged terrain of Mendocino County, about 21 miles south of Garberville. While traffic continued to pass over it a new concrete slab deck was skidded into place on the permanent alignment.

Route 1 has a steady flow of tourist traffic from May through September and carries a heavy truck traffic due to lack of rail facilities. This traffic, because of its commercial character, had to be maintained without interruption. The steep, heavily wooded, narrow ravine of Bridges Creek made it impractical to construct a temporary detour. The unsound condition of the existing wooden Queen Post trusses built in 1917 with a 19-foot laminated timber deck roadway rendered moving of the

old structure under traffic a definite hazard.

The new design called for a 26-foot wide roadway with a concrete deck slab. The existing alignment of two sharp curves and a short tangent was rounded into a 400-foot radius curve continuous over the length of the structure. This necessitated placing the deck on a superelevation of 0.128 of a foot per foot of width. The proposed structure also centered at the vertex of a 400-foot sagging vertical curve, thereby obtaining a better alignment with the existing approach grades.

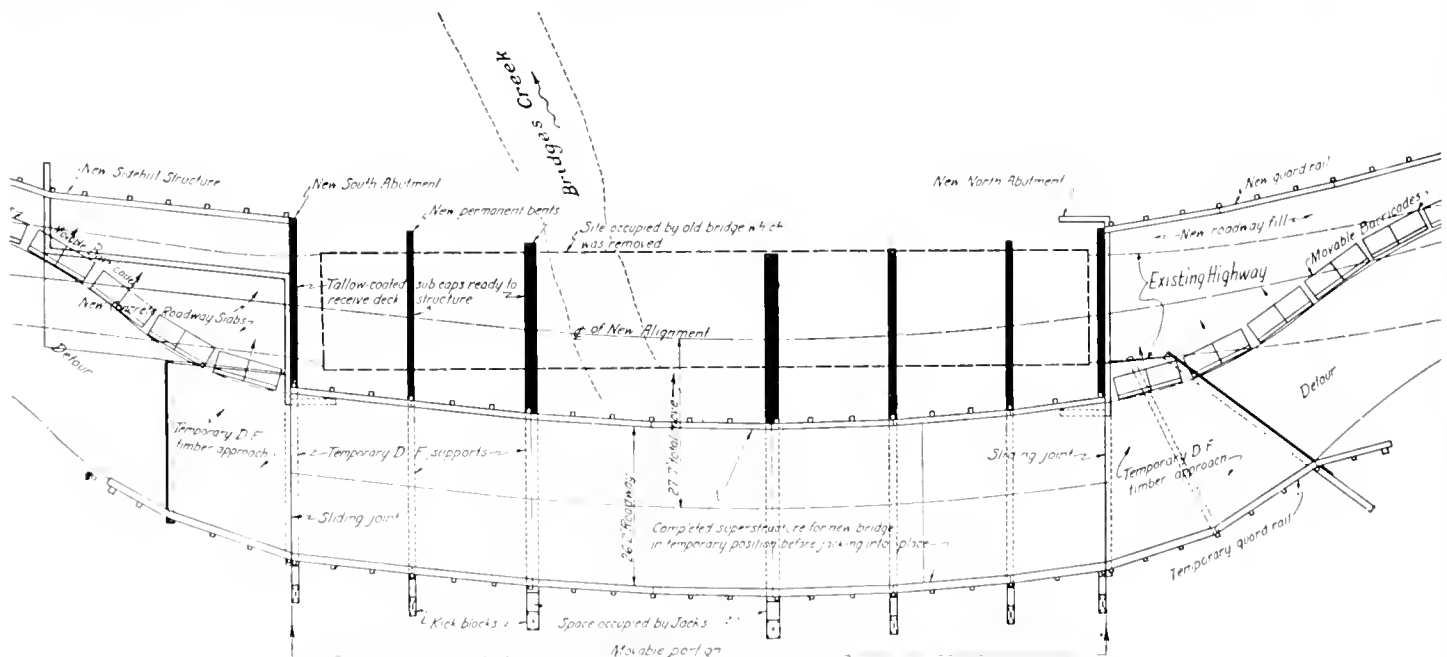
The permanent superstructure for the new bridge was completely constructed above the subcaps in a temporary location on the upstream side of and adjacent to the new alignment, on a similar curve and a continuation of this superelevation, while traffic utilized the existing bridge.

Seven parallel temporary Douglas fir bents were constructed with fixed

subcaps carrying the sliding bridge caps. The contact surfaces were coated with a heavy layer of tallow. The two eaps were joined together with 4 x 14-inch timber seabs to prevent the deck from sliding due to traffic impact. Just prior to the jacking operation these were saw cut an inch below the caps to form sliding guides. Later these were replaced in the permanent location with new seabs. Careful allowances had to be made for future settlement from shrinkage on account of the stacking of the large timbers adjacent to the steel and concrete.

The movable portion of the new bridge consisted of two 19-foot redwood timber spans on the south end, one 38-foot steel stringer span in the center, and two 19-foot spans and one 15-foot timber span on the north end, with concrete deck slabs, timber guards and rails. This entire structure had to be moved as a unit.

(Continued on page 28)



Sketch showing how new concrete slab deck was skidded into permanent position.



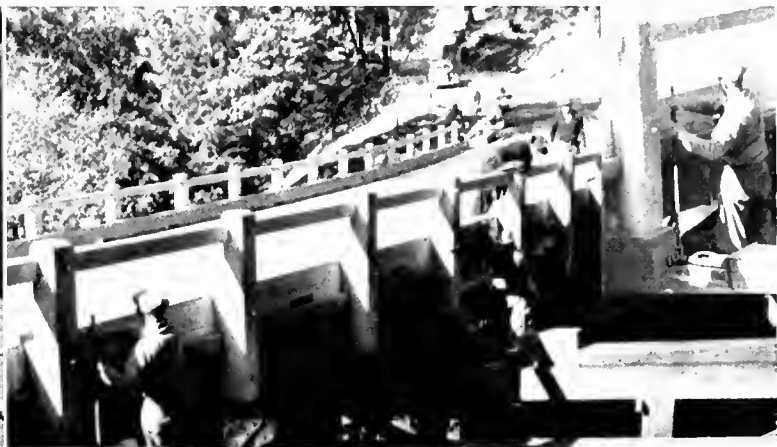
1—Old wooden Queen Post truss bridge which was replaced by modern deck structure.



2—Constructing temporary supports on which new deck structure was built.



3—Partially completed new deck structure with traffic still using old bridge.



4—View of skidding operation in progress, showing jack operators and signal man. Insert shows jack installation.



5—Picture of sliding deck structure approaching final position on permanent supports.



6—View of completed deck showing pleasing effect of new alignment and ample width of roadway.

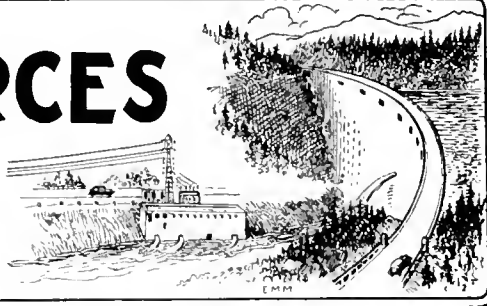
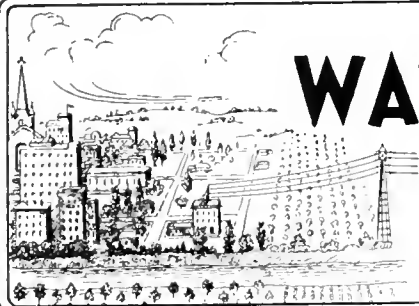
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

February, 1939

EDWARD HYATT, State Engineer



THE activities of the Division of Water Resources in connection with the Central Valley Project have included studies of the water entitlements of several canal companies under the provisions of a crop-land water exchange agreement submitted to the State Railroad Commission for approval, for use in connection with studies being made of the operation and power output of Shasta Reservoir.

A supplemental agreement between the United States of America and the Water Project Authority of the State of California was executed during the month and certain activities were resumed or expanded in accordance with its terms. These included field surveys in connection with the preparation of topographic maps along the San Joaquin River from Friant to the San Joaquin delta; the preparation of a report on properties east of the San Joaquin River claiming rights to the use of San Joaquin River waters; the preparation of a report on soil and land classifications of lands adjacent to the San Joaquin River between the Merced River and the San Joaquin delta; the compilation of data and the preparation of reports on hydrographic and hydrologic surveys on the San Joaquin River and its tributaries during the seasons of 1936-37 and 1937-38; and the compilation of data for a report on crops grown and the use of water on lands adjacent to the San Joaquin River between Friant and Gravelly Ford.

IRRIGATION DISTRICTS

Richvale Irrigation District in Butte County has requested approval of a plan to include 5750 acres of rice land within its boundaries.

Pacheco Pass Water District has completed construction of its storage dam on Pacheco Creek and runoff is now being impounded for percolation in the gravel beds to improve the ground water levels.

Newport Mesa Irrigation District has installed modern deep well pumping equipment to replace the old unit that has been in service for a number of years.

SUPERVISION OF DAMS

Many of the dams recently constructed have been put into use during the last month, including Suttentfield, St. Helena No. 2 and Charles Lee Tilden Park Dam. Dam and outlet control works have been completed on the North Fork Dam in San Benito County and the concrete lining of the spillway channel is being rapidly placed, the excavation having been approved. Applications were filed for the approval of the Calaveras Cement Company Dam in Calaveras County, for the repair of the Woodbridge Dam in San Joaquin County and for the enlargement of the Mountain King Dam in Calaveras County. Of these, the application for the Mountain King Dam was approved.

WATER RIGHTS

During January, 20 applications to appropriate water were received, 7 were denied, 22 were approved, 22 permits were revoked and the rights under 8 permits were confirmed by the issuance of licenses. Among the applications approved during the month was one by the Irvine Company of Tustin, involving an appropriation of 13,000 acre-feet by means of storage on San Diego Creek in Orange County at an estimated cost of \$225,000 and two by Washoe County Water Conservation District of Reno, Nevada, involving an appropriation of 60,000 acre-feet per annum by means of storage on Little Truckee River in Nevada County at an estimated cost of \$1,000,000.

COOPERATIVE SNOW SURVEYS

During the last few days of January and the early days of February the first snow surveys of the 1939 season were made at key courses throughout the major drainage basins on the west side of the Sierra. Measurements made before January 27th indicated a very deficient snow pack, with the amount of snow on the ground less than one-half of the normal amount for that time of the year. The situation, however, improved rapidly during the following week when a succession of storms arrived from the north Pacific Ocean, daily bringing snows

to the Sierra. During the past two weeks, however, fair weather has been general throughout California and little snow has fallen since February 10th. Due to this and the evaporation during the bright sunny days, the snow pack is falling farther below normal each day. Additional storms, which under normal conditions we may expect to get during the next six weeks, are greatly needed to build up the snow pack to prevent a water shortage next summer.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

During the past month the work on this activity consisted for the most part of routine computations in order to compile the annual mimeographed report. One field trip was made to the various river gaging stations to check the stream flow at this time. The sampling of water in the Delta for salinity is being carried on at all regular stations in order that the record of the seasonal advance and retreat of salinity may be complete.

SPECIAL INVESTIGATIONS

Flood Damage Repairs

During the month Senate Bill No. 421 adding \$795,445.51 to the emergency fund for the restoration of property, levees, flood control works, county roads and bridges damaged by the floods of the 1937-38 winter season, became effective when signed by Governor Olson on February 2d.

Investigations and the preparation of reports on work for which application for the allotment of funds have been made were continued and twelve reports and recommendations were submitted to the Director of Finance. The total amount of outstanding allocations at the end of the month was \$4,055,800. In addition to the work being performed by the Division of Water Resources under these allotments, work which will cost \$3,333,200 is being done by applicants under 127 contracts entered into with the Department of Public Works.

FLOOD CONTROL AND RECLAMATION

Relief Labor Work

Under W.P.A. Project No. 10612, sponsored by this department, the following activity is under way:

In Butte County 57 men are engaged in cleaning the channels of Big Chico Creek.

Highway Bids and Awards for the Month of February, 1939

ALAMEDA, CONTRA COSTA AND SANTA CLARA COUNTIES—Apply diesel oil to roadside vegetation, about 129 miles. District IV, Various locations. Lee J. Himmel, Berkeley, \$4,369; Pacific Truck Service, Inc., San Jose, \$3,876; Sheldon Oil Co., Suisun, \$4,675; Garcia Construction Co., Irvington, \$3,927; Hayward Building Material Co., Hayward, \$3,710. Contract awarded to Close Building Supply, Hayward, \$3,553.

CALAVERAS, STANISLAUS, TUOLUMNE AND AMADOR COUNTIES—Furnishing and applying diesel oil to 171.1 miles of roadside. District X, various locations. Oranges Bros., Stockton, \$3,038; Sheldon Oil Co., Suisun, \$2,911; Garcia Construction Co., Irvington, \$3,385. Contract awarded to Pacific Truck Service, Inc., San Jose, \$2,343.60.

HUMBOLDT COUNTY—Across Ohman Creek about 9 miles north of Garberville, a reinforced concrete slab and girder bridge to be constructed and about 0.2 mile to be graded and surfaced with road-mix surfacing and Class "C" seal coat. District I, Route 1, Section B. E. T. Lesure, Oakland, \$31,815; Albert H. Seimer and John Carcano, San Anselmo, \$32,831; Mercer, Fraser Company, Eureka, \$33,416; Valley Construction Co., San Jose, \$33,505; A. Soda and Son, Oakland, \$35,382; Guerin Bros., San Francisco, \$36,561; M. J. Ruddy, Modesto, \$38,832. Contract awarded to E. E. Smith, Eureka, \$30,632.75.

LOS ANGELES COUNTY—North Figueroa Street between Sunset Boulevard and Diamond Street, about 0.4 mile to be graded and paved with asphalt concrete and portland cement concrete, and a reinforced concrete bridge to be constructed. District VII, Route 165, Section L.A. J. E. Haddock Co., Ltd., Pasadena, \$276,898; Bates & Rogers Construction Co., Oakland, \$288,765; John Strona, Pomona, \$289,528; Radich & Brown, Burbank, \$310,905; United Concrete Pipe Corp., Los Angeles, \$317,695; Oswald Bros., Los Angeles, \$317,840; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$338,035; Mitty Bros. Construction Co., Los Angeles, \$350,815. Contract awarded to Griffith Co., Los Angeles, \$275,474.50.

LOS ANGELES COUNTY—An under-grade crossing under the tracks of the A. T. & S. F. Ry. Co. at Chapman Station on Rosemead Boulevard, consisting of steel track spans on reinforced concrete piers and abutments on treated timber pile foundations to be constructed and roadway about 0.3 mile to be graded and paved with portland cement concrete. District VII, Route 168, Section C. Dimmitt & Taylor, Los Angeles, \$119,204; J. E. Haddock, Ltd., Pasadena, \$119,890; Vido Kovacevich, South Gate, \$121,808; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$124,356; Griffith Co., Los Angeles, \$130,477; Oswald Bros., Los Angeles, \$132,631; Oscar Oberg, Los Angeles, \$133,543; Contracting Engineers Co., Los Angeles, \$134,665; Gibbons and Reed Co., Burbank, \$134,728; Byerts & Dunn, Los Angeles, \$144,388; Carlo Bongiovanni, Hollywood, \$146,949. Contract awarded to United Concrete Pipe Corp., Los Angeles, \$117,822.50.

MERCED, MARIPOSA, STANISLAUS COUNTIES—Furnishing and applying diesel oil to 131.4 miles of roadside. District X, various locations. Sheldon Oil Co., Suisun, \$2,614; Oranges Bros., Stockton, \$2,425; Charles Kuppinger, Lakeport, \$2,572; Garcia Construction Co., Irvington, \$2,866. Contract awarded to Pacific Truck Service, Inc., San Jose, \$1,984.50.

ORANGE COUNTY—About 0.3 mile on Glassell Ave., between Fairhaven Ave. and south city limits of Orange, bridge approaches graded and surfaced with asphalt concrete pavement. District VII, Route 181, Section A. C. O. Sparks & Mundo Engineering Co., Los Angeles, \$11,222; Griffith Co., Los Angeles, \$11,455. Contract awarded to Sully Miller Contracting Co., Long Beach, \$8,874.50.

SAN BENITO, MONTEREY, SAN LUIS OBISPO AND SANTA BARBARA COUNTIES—Furnish and apply diesel oil to roadside vegetation for a width of about 9 feet adjacent to right of way lines for a distance of about 202 roadside miles. District V, various locations. Bert Hale, Pismo Beach, \$5,984; L. A. Briscoe, Arroyo Grande, \$6,304; Bradley Truck Co., Santa Maria, \$6,176; Western Motor Transfer, Inc., Santa Barbara, \$6,640; Oilfields Trucking Co., Bakersfield, \$7,168. Contract awarded to R. B. Snow, Santa Maria, \$5,856.

SAN BERNARDINO COUNTY—Across Etiwanda Wash, two reinforced single span slab bridges to be constructed, one located near Etiwanda Avenue about 7 miles east of Ontario and the other located at East Avenue 8 miles east of Upland and about 0.4 mile of approaches to be graded and paved with portland cement concrete and asphalt concrete. District VIII, Routes 26 & 9, Section D & A. Match Bros., Elsinore, \$25,612; Contracting Engineers Co., Los Angeles, \$26,395; J. E. Haddock, Ltd., Pasadena, \$27,098; J. S. Metzger & Son, Los Angeles, \$27,913; White & Wilberg, Santa Monica, \$29,345; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$29,555. Contract awarded to Gibbons & Reed Co., Burbank, \$23,678.15.

SAN BERNARDINO COUNTY—Between San Bernardino and Santa Ana River, about 1.1 miles, plant mixed surfacing to be placed and pile and timber bulkheads to be constructed and backfilled with imported borrow. District VIII, Route 26, Section A. Oswald Bros., Los Angeles, \$39,616; Geo. Herz & Co., San Bernardino, \$41,236; J. S. Metzger & Son, Los Angeles, \$41,161; R. M. Price, Huntington Park, \$45,820; Kiss Crane Service, South Gate, \$47,563; Dimmitt & Taylor, Los Angeles, \$47,828; R. E. Campbell, Los Angeles, \$50,287. Contract awarded to V. R. Dennis Construction Co., San Diego, \$39,133.

SAN DIEGO COUNTY—A reinforced concrete overhead structure over the San Diego and Arizona Eastern R. R. at La Mesa, consisting of one 47-foot span, two 30-foot spans and 2 ten-foot cantilevers on concrete piers. District XI, Route 12, Section L.Msa. The Contracting Engineers Co., Los Angeles, \$25,200; Herman H. Peterson, San Diego, \$25,516; V. R. Dennis Construction Co., San Diego, \$26,401; S. A. Cummings, San Diego, \$26,565; The Robertson Co., Los Angeles, \$28,669; Griffith Co., Los Angeles, \$29,114; White & Wilberg, Santa Monica, \$31,831; Vinson & Pringle, Phoenix, Ariz., \$37,240. Contract awarded to Oberg Bros., Los Angeles, \$25,100.

SAN FRANCISCO COUNTY—In San Francisco, between Lake Street and Golden Gate Bridge approach, 3 viaducts, consisting of reinforced concrete girder spans on reinforced concrete bents and abutments. District IV, Route 56. Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$235,123; Chas. L. Harney, San Francisco, \$254,737; Eaton & Smith, San Francisco, \$255,217; Clinton Construction Co. of California, San Francisco, \$245,306; Bates & Rogers Construction Corp., Oak

land, \$252,099; Barret & Hilp, San Francisco, \$255,952; MacDonald & Kahn Co., Ltd., San Francisco, \$262,467; Maceo Construction Co., Clearwater, \$266,111; C. W. Caletti & Co., San Rafael, \$281,626. Contract awarded to Union Paving Co., San Francisco, \$223,359.20.

SAN LUIS OBISPO COUNTY—Across Paso Robles Creek about 6 miles south of Paso Robles, a reinforced concrete girder bridge consisting of two 48-foot 6 inch spans and two 36-foot 6 inch spans on concrete piers and abutments with timber pile foundations. District V, Route 2, Section B. Valley Construction Co., San Jose, \$43,581; A. Soda and Son, Oakland, \$41,958; J. S. Metzger & Son, Los Angeles, \$45,276; Earl W. Heple, San Jose, \$49,119; M. J. Ruddy, Modesto, \$49,479; M. B. McGowan, Inc., San Francisco, \$49,916; Albert H. Seimer and John Carcano, San Anselmo, \$51,790; Gibbons & Reed Co., Burbank, \$52,547; E. T. Lesure, Oakland, \$53,176. Contract awarded to C. W. Caletti & Co., San Rafael, \$42,326.50.

SOLANO, SAN JOAQUIN, CALAVERAS, AMADOR, STANISLAUS, MARIPOSA AND TUOLUMNE COUNTIES—Furnishing and applying diesel oil to 278.5 miles of roadides. District X, Various locations. Pacific Truck Service, Inc., San Jose, \$5,123; Garcia Construction Co., Irvington, \$5,428; Oranges Bros., Stockton, \$5,240. Contract awarded to Sheldon Oil Co., Suisun, \$4,770.50.

SONOMA, MARIN AND NAPA COUNTIES—Apply diesel oil to roadside vegetation, about 206.9 miles. District IV, Various locations. Garcia Construction Co., Irvington, \$7,371; Chas. Kuppinger, Lakeport, \$6,615; E. A. Forde, San Anselmo, \$6,480; Spaletta & Siri, Santa Rosa, \$6,615; Pacific Truck Service, Inc., San Jose, \$6,426; Lee J. Himmel, Berkeley, \$7,506; Helwig Construction Co., Sebastopol, \$7,371. Contract awarded to Close Building Supply, Hayward, \$5,643.

SONOMA COUNTY—Between Northwood Park and Guerneville, about 3.2 miles to be graded and surfaced with gravel base and armor coat and two reinforced concrete slab bridges and retaining walls to be constructed. District IV, Route 104, Section A. C. W. Caletti & Co., San Rafael, \$217,195; Pomlos, McEwen & M. A. Jenkins, Sacramento, \$214,055; Guerin Bros., San Francisco, \$192,909; Earl W. Heple, San Jose, \$219,561; Chas. L. Harney, San Francisco, \$226,861; A. Teichert & Son, Inc., Sacramento, \$228,643; A. Soda & Son, Oakland, \$241,557. Contract awarded to Heafey Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$184,009.10.

STANISLAUS COUNTY—About 0.4 mile south of Turlock, a steel beam overhead structure with concrete deck across the tracks of the S. P. R. R. to be constructed and about 0.3 mile to be graded and paved with portland cement concrete and asphalt concrete. District X, Route 4, Section A. Earl W. Heple, San Jose, \$284,900; United Concrete Pipe Corp., Los Angeles, \$293,894; A. Teichert & Son, Inc., Sacramento, \$318,834. Contract awarded to Union Paving Co., San Francisco, \$284,102.25.

Don't worry when you stumble—remember, a worm is about the only thing that can't fall down.

We understand that a fireman recently by accident drank some fire extinguisher fluid, and, boy, was he put out!

\$56,809,000 Cost to Modernize Highways in District X

(Continued from page 11)

Snow removal is conducted during normal years on 167 miles, or 12 per cent, of the highways in the district. In addition to which, the spring opening of our mountain roads requires work on 180 more miles of highway. The average yearly cost of this work is \$27,450, or approximately \$790 per mile.

Multiple lane highways account for a very limited percentage of the highways in the district, but traffic is growing on some of the main arteries to such an extent as to demand increasing the number of lanes in the immediate future, especially adjoining municipalities.

We are at present constructing two stretches of divided highways on the main north and south route—U. S. 99; one north of Modesto; the other south of Merced, and the extension of this same type of construction on this main artery should be continued in the future.

There are many bridges, outside of municipalities, that are posted for restricted loading, speed and width, which must be rebuilt or strengthened. The majority of these structures are on county roads that came into the State highway system in 1933, at the time some 6600 miles of roads were turned over to the Division of Highways through legislative action.

The maintenance of these added roads and bridges and also of other inadequate roads in the district is much more expensive than would be the case if they were adequately built, which is not now possible, due to lack of funds.

The average maintenance cost during the past five years for all District X roads amounts to approximately \$750,000 annually. A considerable part of this sum of money could be saved each year if the highways serving the district could be immediately improved to the standard required to adequately meet traffic needs.

While several of the most important railroad grade crossings in the district have been eliminated by separation structures or relocation, many still remain which should be eliminated.

Tourist traffic is a decided asset

to the State, but the mountain roads which were originally built by the counties attracting this traffic are still narrow and crooked and with many steep grades. Safe and adequate highways should be provided for this traffic. The road surfacing is usually of the lower types and requires constant and expensive maintenance.

Snow blocks most of these roads during the winter and those crossing the summits are closed many months at a time as sufficient funds are not available nor are the road surfaces of a type adequate to stand traffic under the extreme winter conditions.

It is becoming more evident that funds are inadequate to keep up with the increasing volume of traffic on the State highways in the district.

To bring the present system up to a standard to adequately care for present conditions, the following expenditures will be required.

54 miles of unimproved earth roads in need of improvement ---	\$2,611,500
510 miles 2-lane oiled earth or gravel roads in need of reconstruction -----	16,509,500
205 miles intermediate improved types of surfacing in need of reconstruction ----	4,959,000
536 miles high type paving portions needing reconstruction--	22,979,000
Railroad grade separations and bridges not included above--	6,750,000
Acquisition of right of way -----	3,000,000
Total -----	\$56,809,000

Based on the average yearly allotment to the district, it will take about seventy years to complete this program, but of course by that time conditions will probably have changed so that a great deal more money will be required.

Assuming sixteen years a reasonable period in which to improve the present roads to adequate standards and not considering added costs for increased requirements, it will call

for an annual expenditure of \$3,500,000. This is about twice the average annual expenditure at present in the district for all items of work — construction, maintenance, surveys and plans, right of way, construction engineering, minor improvements and betterments, administration, cities, etc.

In the meantime, we must concentrate on those highways having the greatest needs, giving full consideration to maintenance cost, traffic and safety requirements.

New Sepulveda Link Opened

(Continued from page 18)

has not yet been constructed due to the fact that it would pass across lands subject to inundation during the rainy season of the year. At present, adjacent paved streets are used to carry traffic around this portion. Before constructing this short section it will be necessary to work out a comprehensive drainage plan for the surrounding area, to be financed in such manner that the cost will be divided in accordance with the benefits to be derived by furnishing proper drainage for this area.

It is contemplated that further improvements in alignment will be made on the section through the Santa Monica Mountains as some of the present curves would be hazardous for the very large volume of traffic which may be ultimately expected to use this thoroughfare.

One of the most important improvements now contemplated is the reconstruction on widened right of way of the portion between Ventura Boulevard and the southerly end of the recently completed paving contract at Brand Boulevard. Surveys for this 8.1 mile section are being carried on by the city of Los Angeles with the intention of constructing it ultimately as a six-lane divided highway.

Sepulveda Boulevard in its present stage of development is capable of carrying a large volume of traffic along the westerly side of the Los Angeles metropolitan district.

New Channelization in the City of Oakland

(Continued from page 20)

angle. An acute angle intersection of two highways having the gore of such an intersection paved or even graded to the approximate level of the intersecting highways, with no channelization but the pavement lane stripes, permits numerous unexpected movements of traffic.

With plenty of space, traffic inclines to roaming. The approaching traffic, proceeding in the proper channel, has no assurance that traffic will follow the course that might be expected to be taken by a careful driver.

Proper channelization will reduce the unexpected movement of traffic by reducing the possible intersection points to a definite number and location.

Every time a new method of traffic movement is utilized, it takes time for the driver to become used to the device. Thus, the design of channelization at intersections should be as simple as possible, but the channelizing should be definite. Traffic will require careful signing to utilize the different lanes.

The most common method of directing traffic into the proper highway is by the use of triangular deflector islands. When the traffic has turned past these deflector islands, the usual method of confining them is by lane striping. The city of Oakland has connected these deflector points by a curb which forms a definite channelization.

CHANNEL CURB USED

Another feature of the Oakland channelization is a pronounced step in the use of a channel curb on the highway in advance of the turning points, to keep approaching traffic separated into the proper lanes.

The accompanying photographs and sketch show how these channels are outlined. The sketch also shows the method of directing traffic.

Safety measures such as curb inserts, flashing yellow lights in the approach points of the islands, and sodium vapor lights at the points of intersection are used.

This channelizing has proved the value of furnishing definitely-separated lanes for traffic.

Golden Gate Exposition Brings Traffic Increase to Bay Bridge

THE highest month in daily average number of vehicles crossing the San Francisco-Oakland Bay Bridge since ferry rates were cut in August, 1937, was recorded for February, it was revealed in a report by Chief Engineer C. H. Purcell filed with Director of Public Works Frank W. Clark.

For the twenty-eight-day month an average of 26,556 vehicles used the bridge, an increase of 448 vehicles over November, highest previous month.

A total of 743,573 vehicles were recorded for February as compared to 593,121 for the same period last year.

The highest day last month was Friday, February 17, immediately preceding the opening of the exposition, when 36,001 vehicles crossed the bridge.

The lowest day since exposition opening was Monday, February 27, with 25,052, and high point since the Treasure Island premiere was Washington's Birthday, February 22, with 35,967 vehicles using the bridge.

To the exposition can also be attributed an increase in freight tonnage to its highest point since the span opened, the report indicated. A total of 67,301 tons were transported across the bridge in February as compared with the previous high of 62,421 tons in January, a 31-day month. Approximately 5,500 tons alone were transported over the bridge on February 16, highest single day.

Of a total of 599,998 visitors who paid admission to the exposition from the opening of Treasure Island on February 18 to the close of the month, the bay bridge carried 214,638.

Traffic has operated smoothly over the span, without congestion of any kind, except on Washington's Birthday, February 22, when vehicles slowing up at the exposition admission gates caused the cars to line up on the bridge for a short period of time.

At all times, however, bridge toll collectors were able to handle traffic speedily and efficiently.

Highway Engineers Honored for Work

Thomas E. Stanton, Jr., engineer in charge of the Testing Laboratories of the Division of Highways, has been notified by the board of directors of the American Concrete Institute, Detroit, that he and his assistant, Lester C. Meder, have been awarded the Wasson medal for noteworthy research during 1938. The award was based on a paper prepared by Stanton and Meder on "Resistance of Cement to Attack by Sea Water and by Alkali Soils," which was published last year in *CALIFORNIA HIGHWAYS AND PUBLIC WORKS*, official publication of the Department of Public Works.

The Wasson award was founded by the late Leonard C. Wasson of Boston, the second president of the American Concrete Institute, and was first made in 1928. The award will be announced at a dinner of the Institute and the medal forwarded.

Prado Dam Project Compels Relocation

(Continued from page 14)

Surfacing will consist of a 22-foot width of plant-mixed surfacing placed on a blanket of surfacing material obtained from roadway excavation.

The plant-mixed surfacing is to be placed to one side of the center line of the graded section to conform to one-half of the ultimate four-lane, divided highway.

At the easterly terminus of the project to make a satisfactory connection to the wide portion of the highway within the city of Corona, a section of portland cement concrete pavement 48 feet in width will be constructed.

In addition to materially decreasing the maximum grade and eliminating numerous horizontal and vertical curves, the distance between Corona and the Orange County line will be reduced to the motorist by approximately one mile.

Skidded Bridge Superstructure

(Continued from page 22)

It was necessary to build a temporary fixed timber approach span at each end with roadway approaches. On completion, traffic was diverted to the new deck structure.

Fifteen temporary movable barricades were used to guide and protect traffic throughout the construction. These were well adapted for the use intended and found to be quite adequate without additional guard rails or fences. Upon completion of the contract these barricades were turned over to the local Maintenance Department.

The next step was the dismantling of the old bridge, including a log crib at the south end. The permanent abutments, bents, side-hill structure and approaches were then constructed. These redwood bents were built parallel to those carrying the new deck, with their subcaps in alignment with and scabbed to the temporary subcaps.

Twenty-ton capacity ratchet screw jacks, one to each of the seven bents, were then blocked in position at the top of the subcaps. Due to the skew of the bents and curvature of the deck it was necessary to keep close adjustment on the relative positions of the seven sliding caps. This was visually done by attaching ordinary yard sticks to the subcaps.

Jacking operations were started with one man operating each of the seven jacks, guided by a signal man stationed at the middle of the bridge. The proper speed was two ratchet movements per signal.

The entire superstructure was moved 26 feet, 7 inches, in seven hours and the total movement into position on the permanent alignment was completed in 11 hours. The cost of jacking the superstructure into position was considerably under the amount estimated and the rate of progress greatly exceeded all expectations. The ease with which the structure moved was gratifying. Traffic was continuously maintained throughout this operation.

All timber connections in both temporary and permanent bents were made with 4-inch split ring connectors and galvanized hardware. The use of ring connectors throughout the

Motoring Visitors In Twelve Hundred Cars Enter Daily

California is still the Mecca for out-of-state motor tourists.

Despite a general decline in automobile mileage throughout the nation in 1938, foreign passenger cars entered the State at the rate of 1183 vehicles per day bringing in an estimated 1,196,086 visitors.

Official figures from the State border quarantine stations revealed that Southern California again was the favorite entrance point for out-of-state visitors. Out of a total of 20 border stations, the five south-land checking points accounted for more than half of entering cars.

State Control of Water and Power

(Continued from page 5)

Originally conceived as a State enterprise, adopted by State legislation and approved by state-wide referendum election in 1933 the Central Valley Project involving an estimated cost of \$170,000,000 is now a fully authorized and approved Federal undertaking with initial funds appropriated therefor and construction already well under way. The project is being constructed by the United States Bureau of Reclamation of the Department of the Interior.

Units under construction include the Shasta Dam and power plant, and certain supplemental works most important of which is the relocation of a portion of the Southern Pacific Railway (Shasta route) to replace the present line which will be submerged by the reservoir; and the Contra Costa conduit. Camp facilities have been constructed at Friant dam.

Funds appropriated by the Federal Government thus far for the project total \$34,600,000 of which about \$8,000,000 has been spent to date.

construction insured positive alignment of the timbers at all times with a minimum of slip and racking.

The construction was begun on May 23d and completed on November 2, 1938, at a total cost of \$25,000 which included the work on the roadway approaches. The contractor was Claude C. Wood of Lodi, California.

Rumsey Bridge Opened to Traffic

COMPLETING another link of a more direct route between Sacramento and Clear Lake via Capay Valley, the new Rumsey bridge constructed across Cache Creek in Yolo County by the Division of Highways was officially opened to traffic on Sunday, February 26.

Dedication of the structure was a feature of the annual Capay Valley Almond Blossom Festival and was witnessed by more than 2000 persons.

As the representative of Governor Culbert L. Olson and Frank W. Clark, Director of Public Works, Fred W. Panhorst, Bridge Engineer of the Division of Highways, was the principal speaker and formally dedicated the bridge. He was introduced by Assemblyman John H. O'Donnell of Woodland. Lindsay Van Tongeren, secretary-manager of the Woodland District Chamber of Commerce, was master of ceremonies.

In addition to the bridge proper, the Rumsey project includes approximately 2500 feet of road approaches, which are constructed to present day standards of alignment. The road-bed is 26 feet in width, 22 feet of which consists of road-mix surface treatment. Due to cold weather, oiling operations on the approaches have not been completed.

The new bridge is of reinforced concrete of rigid frame type. The footings are founded on shale rock. The structure is 375 feet long with two 56-foot, 6-inch spans, two 58-foot spans, two 60-foot spans and two 16-foot cantilever spans. It has a clear roadway width of 26 feet between curbs. Some of the items involved in the construction of this project are as follows:

Roadway excavation, cu. yds.	15,000
Structure excavation, cu. yds.	4,200
Concrete, cu. yds.	1,400
Reinforcing steel, lbs.	260,000

The new bridge replaces a temporary structure built in 1934 and washed out by high water in December, 1937.

Vaudeville Singer: "And for Bonnie Annie Laurie, I'd lay me down and die."

Listener (rising): "Is Miss Laurie in the audience?"

STATE OF CALIFORNIA

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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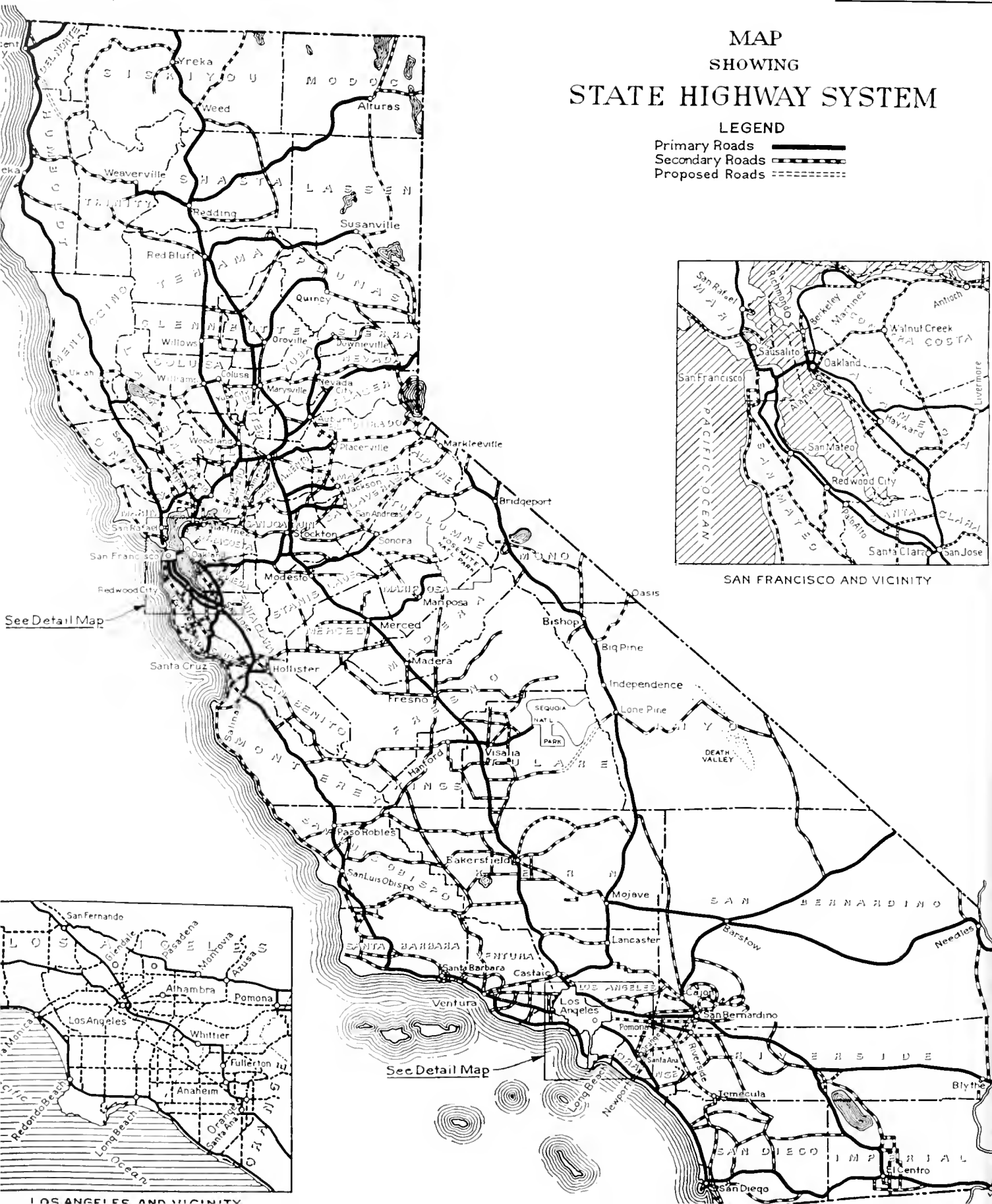
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MAP SHOWING STATE HIGHWAY SYSTEM

LEGEND

Primary Roads 
Secondary Roads 
Proposed Roads 



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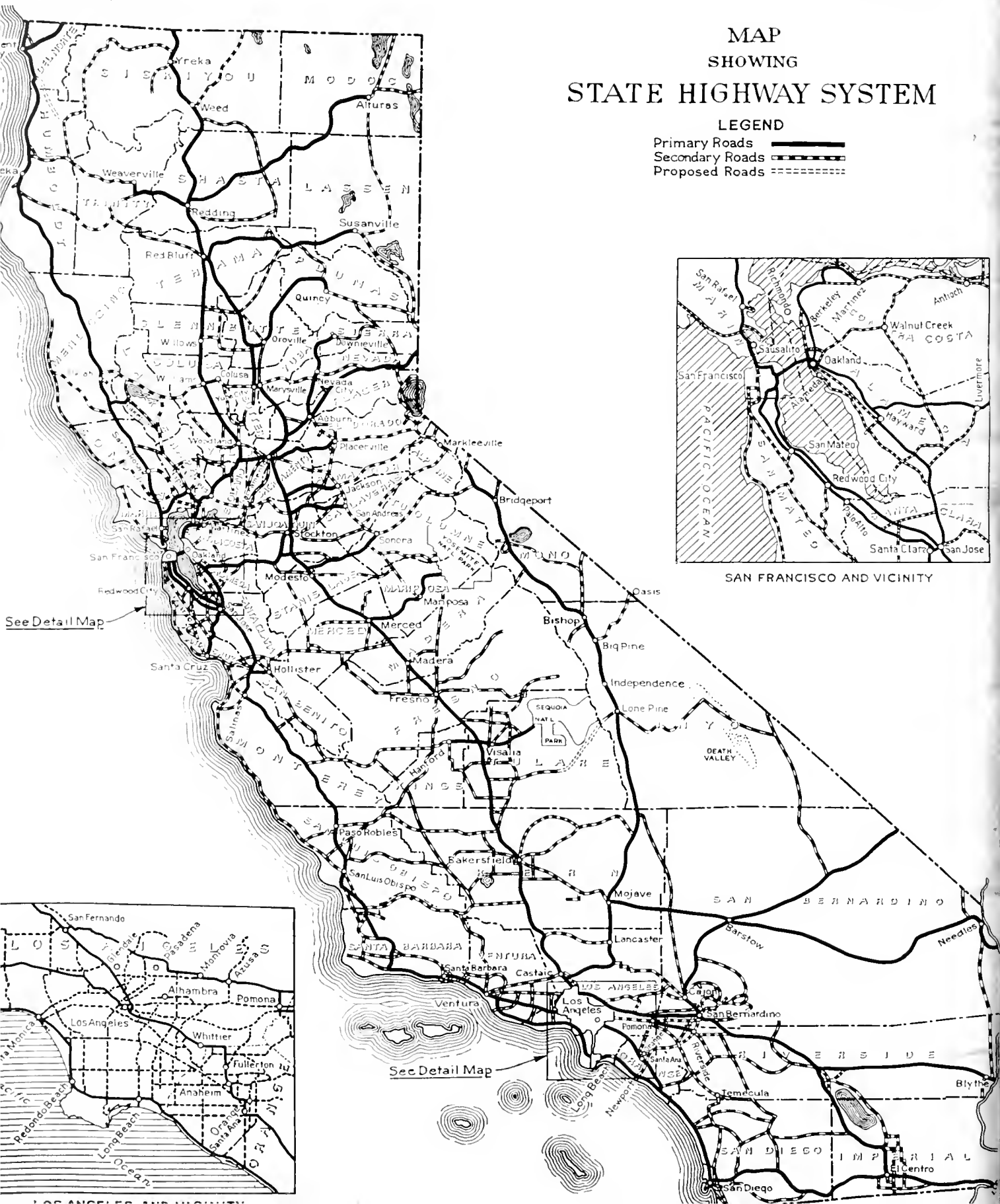
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CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



*Snow Surveyors Measuring
Water Content Of
Sierra Pack*

(See Article on Page 4)

**APRIL
1939**

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

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No. 4

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California Highway Survey Shows Big Decline in Funds on Per Mile Basis for Roads

FUNDS on a per mile basis for State highway purposes, both in urban and rural areas, have declined to the level of 1927, when the gas tax was increased from two to three cents.

This has occurred despite Emergency Federal Aid appropriations, which, between 1932 and 1938, provided 13.2 per cent to 24.5 per cent of all State highway funds.

As a result of this declining revenue, replacement of the rural State highway system, due to obsolescence and depreciation, is falling behind at the rate of 151 miles of road surface and 38 bridges each year.

The financial situation will not improve during the coming biennium (July 1, 1939, to June 30, 1941) as the State's Federal Aid appropriation for this period has been reduced some 26 per cent.

These and other facts developed from the California State-Wide Planning Survey, conducted by the United States Bureau of Public Roads and the California Division of Highways, were submitted to Governor Culbert L. Olson in a report by Director of Public Works Frank W. Clark.

DAILY TRAFFIC AVERAGES 14050

The rural State highway system carries 71.2 per cent of all traffic which occurs on rural roads, according to this report. Only 8.3 per cent of the mileage in the system carries less than 100 vehicles per day, the average for the remainder being 14,050 vehicles per day. This is in marked contrast with the county road system, where but 16.2 per cent of the roads has a traffic exceeding 100 vehicles per day, with an average of 392 vehicles for this portion.

With about twice the number of motor vehicles using the State highways last year as compared to the 1,368,205 motor vehicles registered in 1924, and with State highway mileage virtually doubled by legislative action since 1933, the State has only

Survey Highlights

California ranks first among the states in total vehicle registration and forty-fifth in average motor and gas receipts per motor vehicle.

Funds on a per mile basis for State highway purposes, both in urban and rural areas, have declined to the level of 1927, when the gas tax was increased from two to three cents.

From 1924 to 1928 the average annual expenditure per mile on the State highway system was \$2,900; from 1929 to 1933 it was \$4,800, and from 1934 to 1938 it again was \$2,900.

The rural State highway system of 12,637 miles serves 71.2 per cent of all traffic on the rural roads.

On the rural State highway system, 11.7 of the bridges are restricted as to loading.

A total of 6549 miles, or 51.8 per cent of the rural State highway system, has a traveled way less than 20 feet wide.

mileage remained practically constant. Within the third period, the mileage was approximately doubled, and available funds were curtailed by the allocation of one quarter cent of the gas tax fund to major streets in cities. An additional one-quarter cent of the gas tax funds, included in the total shown as expended on the State highway system, was also definitely earmarked for State highway routes within cities. As a result, the average funds available per mile of road for the State highway system, both urban and rural, have declined to the level of the 1924-1928 period.

On the basis of an engineering estimate of \$503,000,000 required for improvement and reconstruction of the State highway system, exclusive of right of way, a period of 25 years will be required to carry out the program with the present annual revenue.

SURVEY STILL IN PROGRESS

The State-Wide Planning Survey has been under way since 1936 as a cooperative project with the United States Bureau of Public Roads. Similar surveys are being conducted in 46 States, following out a suggestion made by President Roosevelt to the Department of Agriculture in 1935.

The report is divided into two parts. Part I deals with all rural roads combined regardless of jurisdiction. Part II deals with the rural State highway system—that is, those State highways outside incorporated cities.

Six series of maps—namely, a base map and five special service maps consisting of general highway, postal routes, school bus routes, traffic map and common carrier routes—have been completed and are available. These maps are on a scale of 1 inch = 1 mile; and there are 303 sheets in each series.

The tabulation and collection of information in the form desired by the United States Bureau of Public

\$2,900 per mile of State highway to expend, the same amount it had during the period 1924-1928.

The effect of changes in taxation, allocation of funds and increase of mileage on the State highway system for the years 1924 to 1938 may be considered as comprising three five-year periods.

Years	Average annual expenditure per mile on State highway system
(1) 1924 to 1928	\$2,900
(2) 1929 to 1933	4,800
(3) 1934 to 1938	2,900

During the first of the three periods, there was an increase in mileage. In the second period, the increase in gas tax was evident, and the

Roads to conform to the country-wide survey, is still in progress.

The report contains information as to the present status of rural roads, the traffic thereon, and the funds available for their improvement and maintenance.

HIGHLIGHTS OF SURVEY

Highlights of the survey are presented herewith:

1. 73,939 miles of the 99,560 miles in the combined rural road system, that is, the rural State highway and county road systems, carry less than 100 vehicles per day.

2. 25,621 miles of a combined rural road system carry traffic from a minimum of 100 vehicles to a maximum of 28,500 vehicles per day.

3. The rural State highway system of 12,637 miles serves 71.2 per cent of all traffic on the rural roads.

4. The county road system of 86,923 miles serves 28.8 per cent of all traffic on the rural roads.

5. One-third of the combined rural road system has curvature of 400 foot radius or less, and one-twelfth of the mileage has grades in excess of 7 per cent. Two-thirds of the mileage is classed as valley type road, and the remainder foothill or mountain type.

11606 MAJOR BRIDGES

6. There are 220.9 miles of bridges in the combined rural road system made up of 11,606 individual structures of 20 feet or more in length.

7. 73.6 per cent of the bridges on the county road system and 22.1 per cent of those on the rural State highway system are less than 20 feet in width.

8. 11.7 per cent of the bridges on the rural State highway system are restricted as to loading.

9. There are 6025 railroad grade crossings in the combined rural road system, 5399 are on county roads, and 625 on the rural State highways.

10. There are 187 railroad grade separations on the county road system and 202 on the rural state highway system.

11. 22 intersections of county roads have been improved with highway grade separations, and 10 highway grade separations have been effected on the rural State highway system.

12. 47.1 per cent of the combined

type of surface than the traffic warrants.

14. 2680 miles of the county road system and 2858 miles of the rural State highway system have a lower type of surface than the traffic warrants.

15. 86.1 per cent of the combined rural road system has a traveled way less than 20 feet wide. This portion carries 39 per cent of the total rural road traffic.

16. 79,137 miles, or 91 per cent of the county road system has a traveled way less than 20 feet wide.

17. 6549 miles, or 51.8 per cent of the rural State highway system has a traveled way less than 20 feet wide.

18. 80 per cent of all rural dwellings are concentrated along 25 per cent of the combined rural road system.

19. 84.4 per cent of all rural dwellings are located along surfaced roads.

20. There is an average of 4.57 dwellings per mile on the county road system and 3.39 dwellings per mile on the rural State highway system.

ROAD AND STREET BONDS

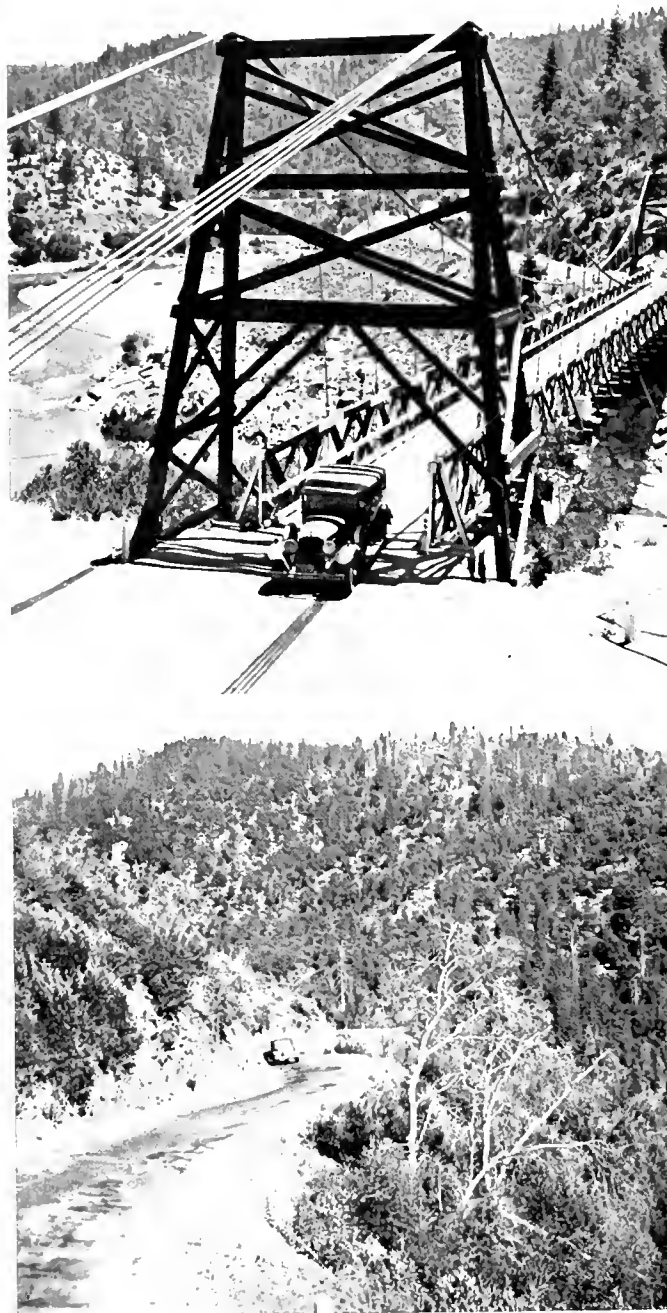
21. Road and street bonds outstanding in 1936 totaled \$167,209,442. This amount is divided between State, county, and city governments in the proportion 30, 30 and 40, respectively.

22. Bond interest and redemption required 24.1 per cent of the \$82,500,226 expended in 1936 for roads and streets.

23. The percentage of bond service included in the total road and street expenditures of each governmental unit is as follows:

State	10.6%
County, including County Road and Joint Highway Districts	30.3%
Cities	42.3%

24. \$9,890,890 of the \$89,184,288 available for road building in 1936 was apportioned for nonhighway purposes. Approximately two-thirds of the \$9,890,890 was for vehicle registration and regulation, and one-third for the State general fund; the apportionment to the general fund is in



On rural State Highway System 22.1 per cent of bridges and 51.8 per cent of roads are less than 20 feet wide.

rural road system in California is of the unsurfaced type.

13. 30,021 miles of the county road system and 1075 miles of the rural State highway system have higher



Traffic conditions require widening of 598 miles of 2- and 3-lane highways into 4-lane divided highways to eliminate accidents like the above.

addition to the \$4,095,950 allocated for bond interest and redemption of State highway bonds.

25. Each governmental unit raised the following percentages of the total road and street revenue:

Federal	11.33	
State	68.05	
County, County Road Districts, and Joint Highway Districts	8.72	
Cities	11.90	100.0%

26. The sources of revenue for roads and streets and the respective percentages raised were:

Vehicle Fees, Taxes, Etc.	70.09	
Sale of Bonds63	
Federal Aid	11.33	
General Property Taxes	17.95	100.0%

27. \$62,658,569 out of \$89,184,288, was expended for actual work on roads and streets. The percentage and type of work performed was as follows:

Construction	60.2	
Maintenance	31.1	
Administration	7.4	
Unclassified	1.3	100.0%

COUNTY TAXES DECREASED

28. General property taxes levied by the counties specifically for road construction and maintenance have steadily declined from \$8,075,473 in 1931 to \$2,451,636 in 1938.

29. \$2,800,429 of gas tax funds was diverted in 1938 by 21 counties to apply on 1933 and 1934 relief bonds.

30. Replacement of the rural State highway system due to obsolescence and depreciation is falling behind at the rate of 151 miles of road surface and 38 bridges each year.

31. There are 8062 locations on the main United States numbered routes where the sight distance is less than the safe passing sight distance recommended by the Design Committee of the American Association of State Highway Officials. At 4645 of these locations the sight distance is less than the recommended safe stopping distance at the maximum legal speed.

32. There are 2704 miles of intermediate type surface in the rural State highway system which should be paved to properly care for traffic.

33. There are 598 miles of two- and three-lane rural State highways which warrant widening to four-lane divided highway.

34. The improvement possible in the rural State highway system is evidenced by the shortening of 88 miles in the reconstruction of some 600 miles of road between 1933 and 1937.

35. California ranks first among the States in total vehicle registration and forty-fifth in average motor and gas receipts per motor vehicle.

CARTWRIGHT CALLS FEDERAL AID "INVESTMENT"

Speaking before the recent annual convention of the American Association of State Highway Officials, Representative Wilburn Cartwright of Oklahoma, chairman of the House Committee on Roads, made this statement: "Federal aid for highways is not a current expenditure, but rather an investment in a national capital asset."



Snow surveyors making their way on skis into the high country near the summit of the Sierra.

Snow Pack 50% Below Normal

By FRED H. PAGET, Associate Hydraulic Engineer

DURING the last days of March and the first few days of April complete measurements of the California snow pack were made in all the watersheds of the Sierra Nevada. This survey is made each year to determine the water producing potentialities of the snow blanket that has been laid down at high elevations during the winter.

As a general rule, at the first of April, the mountain snow pack has reached its maximum for the winter and the runoff is about to begin. From the measurements of snow depth, density and water content made by the snow surveyors, can be computed the amount of water that will flow down the snow fed streams of the Sierra during the months of

April, May, June and July as warmer weather ereeps gradually up into the mountains and causes the snow pack to melt.

To California with its rainless summers, the waters that flow down the mountain streams during the dry season are necessary for the prosperity and well being of all its citizens. Commerce, manufacturing, agriculture and mining require a dependable year round supply. Because of this importance of the water supply, advance information of runoff prospects is eagerly sought by those organizations and individuals responsible for the control and regulation of the mountain water, so that schedules for storage and diversions may be intelligently prearranged to permit efficient operation.

The State began to oversee this work in 1929. Before then only a few of the larger water users attempted to measure the snow pack and there was no coordination of their efforts. Today with State participation, standardization of equipment and methods has been effected and with more opportunity for research as to forecasting procedure more accurate results are being obtained.

The value of this work is fully appreciated by the water using organizations and now most of them are cooperating. During the past year about 60 per cent of the cost of the snow surveys and work incidental thereto was absorbed by the co-operators with about 40 per cent of the cost being paid from State funds.



1. Coupling the snow measuring tubes.
2. Measuring distances between sampling points.
3. Pushing the hollow sampling tube down to earth.
4. Weighing snow core. Scale shows water content.



This year because of the shortage of rain in the valleys of California there has been great interest in the snow pack accumulation and a correspondingly greater demand for information as to next summer's expectations of runoff. Progress snow surveys have been made at selected key snow courses throughout the winter to keep in touch with the general situation.

The accumulation of snow during the early winter was very slow; the amount of snow on the ground near the end of January being less than one-half of the amount usually down by that time. On January 27th, however, a storm period began that lasted intermittently until February 11th, and during this time as much snow fell as had accumulated during the entire winter prior to the time the storm started. At the end of the storm period, although the snow pack was still below normal, more optimistic hopes for the balance of the winter were being entertained.

The weather during the balance of the month of February was decidedly

disappointing as from February 11th until March 4th little snow fell in the mountains. Two short storms early in March helped a little, especially in the northern Sierra where the shortages had been greatest, but from the Merced River south these storms added but little snow.

Since the middle of March, except for one very minor storm, the accumulation of snow in the Sierra has been at a standstill. Under the influence of the warm days of the last half of March the runoff has started and much of the snow has melted up to as high as 7000 feet. Below this many of the slopes facing south are entirely bare and the snow on the north slopes is also fast disappearing; a condition which does not usually occur until the first of May, a month from the date this is written.

Although the snow surveyors were glad to have fine weather while in the mountains making the annual check up, even this was not without its drawbacks, for the fine weather made the going tough. Where the men had to cross over the south slopes, snow

and bare patches of ground often alternated so that they were continually taking off their skis to carry them in their hands across the open patches, and then putting them on again for a brief space where the snow lay too deep to allow walking without them. This "off again, on again" method of traveling was very tiring especially when carrying a heavy pack. Even where the snow was continuous, since it froze but slightly at night, after ten o'clock in the morning, the snow was mushy and the going heavy.

During the two weeks of snow measuring about 150 men took part in the snow patrols traveling an aggregate total of about 4500 miles to measure a snow pack covering an area of approximately 17,000 square miles. Some of the patrols were long, some were short, most of them were arduous and many of them hazardous. Shelter cabins along the route were stocked with food and bedding, but personal effects and the hollow tubes and weighing scales for measuring the

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Men of the snow survey carry full equipment in large packs on their backs making tough going in soft snow.



The recently appointed members of the California Highway Commission, grouped about Director of Public Works Frank W. Clark, seated in center are (left) Lawrence Barrett, chairman; (right) Bert L. Vaughn. Standing, left to right, Secretary Byron N. Scott; Iener W. Nielsen; Amerigo Bozzani; L. G. Hitchcock.

New Highway Board Meets

GOVERNOR CULBERT L. OLSON'S new California Highway Commission met for the first time in Sacramento on March 17 and organized. The purpose of the meeting was to enable the commissioners to get acquainted with each other and to hear from Director of Public Works Frank W. Clark, State Highway Engineer C. H. Purcell, and engineers of the Division of Highways an outline of the work confronting them.

With Chairman Lawrence Barrett of San Francisco presiding, the new members attending were L. G. Hitchcock, Santa Rosa; Iener W. Nielsen, Fresno; Amerigo Bozzani, Los Angeles, and Bert L. Vaughn, Jacumba.

Byron N. Scott of Long Beach officially assumed his duties as secretary of the commission.

Assembling again on March 31, the commissioners learned something about the magnitude of the job ahead of them when they sat in an all-day session with delegations from many parts of the State which appeared before them on highway matters.

At this meeting the commission considered one of the problems bequeathed it by its predecessors. This was the controversy between the State and the City and County of San Francisco over the basis on which the cost of the \$1,800,000 Funston Avenue approach to the Golden Gate Bridge shall be shared. The question

of whether the new commission is legally and morally bound to fulfill a contract entered into by the former Highway Commission with San Francisco, under the terms of which the State was to bear two-thirds and San Francisco one-third of the cost of the Funston Avenue project, was referred to C. C. Carleton, chief attorney of the Department of Public Works, for an opinion.

The commission afforded hearings on applications for budget appropriations for highway projects presented by delegations from Contra Costa, San Francisco and San Mateo, Sutter and Yuba, Sierra, Kings, and Tulare counties, and from the Redwood Empire Association.



Lawrence Barrett



L. G. Hitchcock



Amerigo Bozzani

FOR twenty years, Lawrence (Larry) Barrett made the study of highway traffic and transportation problems a hobby. Now, as chairman of the new Highway Commission, appointed by Governor Culbert L. Olson, he is afforded the opportunity of making his hobby pay dividends to the State of California.

Attending the first meeting of the new commission on March 17, Mr. Barrett said:

"From my experiences in traveling through Europe and the United States, I am convinced that California has the greatest network of highways in the world, but is confronted by many growing problems brought about by increased motor vehicle traffic which are yet to be solved."

Chairman Barrett proposes to devote most of his time during the next four years to seeking solutions to these problems. Owner and operator of nine large garages in San Francisco, Mr. Barrett delegated to appointed managers in recent years the administration of his properties and has pursued his hobby of studying highway problems. He has traveled over nearly every road and highway in the State.

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ONE of two lawyers on the new California Highway Commission, L. G. Hitchcock, is city attorney of Santa Rosa. Residing, as he does, in Sonoma County, he is thoroughly familiar with the highway problems in the great Redwood Empire.

Mr. Hitchcock, who was born on a small farm on the outskirts of Bakersfield, California, on November 26, 1901, is the youngest Highway Commissioner ever to be appointed in this State. He received his primary school training in Kern County and Los Angeles. He was still attending classes when the United States entered the World War. Even as a young fellow, he had very pronounced ideas on American patriotism and on December 30, 1917, at the age of 16 years, he joined the Navy. As a matter of fact, he was just one month past his sixteenth birthday when he entered the service of his country.

On September 30, 1919, after almost two years in the Navy, he was discharged and returned to the studies he had temporarily abandoned. In June, 1921, he was graduated from the Kern County Union High School and entered Stanford

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REMOVING from New York to Los Angeles in 1911, Amerigo Bozzani, with his brother, Joseph, opened a modest garage for the repair of bicycles and motorcycles. From that small beginning has grown the Bozzani Motors, Ltd., of which Amerigo Bozzani is president and general manager. This concern is one of the largest of its kind in southern California.

Trained in the mechanical trades in some of the best schools of Italy, Amerigo Bozzani, at the age of 17, traveled extensively in Europe, engaging in work in his chosen vocation. In 1903 he came to this country and for two years gained experience in large machine shops in eastern States. He returned to Italy in 1905 and, following a brief visit in Rome, toured the Mediterranean coast of Africa and Asia Minor, later going to Spain, France, England and Scotland. He returned to the United States in 1906 and became an expert in the automotive industry.

Determined to enter business for himself, Mr. Bozzani went to Los Angeles in 1911 and on February 14, 1912, he and his brother opened the doors of the Bozzani Autocycle Repair Shop. In 1918 the Bozzani Motor

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Iener W. Nielsen



Bert L. Vaughn



Byron N. Scott

FRESNO County is represented on the new California highway Commission by a lawyer-farmer who has found time to interest himself in the State's far-flung road building program. He is Iener W. Nielsen, prominent Fresno attorney.

Mr. Nielsen, son of Mr. and Mrs. C. Nielsen, Fresno County ranchers, spent his boyhood days on the farm of his parents. He attended the public schools of Oleander and Easton in his home county and graduated from the Washington High School in Easton.

For one year following his graduation, Mr. Nielsen worked for the Southern Pacific Railway in Oregon and then went to Des Moines, Iowa, where he attended Highland Park College for a term. Returning to the west, he entered the University of Southern California, where he majored in law, graduating in 1912.

Since 1912 Mr. Nielsen has practiced law in Fresno and also engaged in farming.

In 1918 he married Miss Esther Dahlgren. The couple have two children, Barbara and James, both of whom are students in the Junior High School in Fresno.

Mr. Nielsen is a Mason and active

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BORN in West Virginia, Bert L. Vaughn lived his boyhood in that State and in Kentucky. At the beginning of the Spanish-American war he enlisted with the First West Virginia Volunteers and served about one year in Cuba.

His business career began in 1901, when he engaged in the hotel business in Hot Springs, Ark., moving from there to Needles, California, to take up real estate and mining pursuits. During his residence in Needles, between 1907 and 1909, he became vice president of the Parker Bank and Trust Company, of Parker, Ariz., and founded a town on the boundary line between California and Arizona, calling it Calizona.

In 1913 Mr. Vaughn established headquarters in San Diego and for the five years following he operated mining properties in California and Arizona. In 1918 he became a member of a syndicate which built the Barbara Worth Hotel in El Centro, on the completion of which he was chosen as its manager. It was while he was a resident of El Centro, in 1918, that he acquired property in Jacumba and began the building of that town, of which he has since been manager. During the last three years

(Continued on page 23)

FOUR years in Congress, ten years as a teacher of political science and economics, a master's degree in political science and an A.B. degree in government are the outstanding qualifications of Byron N. Scott of Long Beach, recently appointed as secretary of the State Highway Commission by Governor Culbert L. Olson.

Mr. Scott is well known in State and national democratic political circles. He is a native of Kansas and graduated from that State's university with an A.B. in government in 1924. He came to California in 1926 after two years in Tucson, Arizona, and completed the necessary requirements for a master of arts degree in political science at the University of California. For eight years he taught this subject in the Woodrow Wilson High School in Long Beach.

He was elected to Congress from the Eighteenth Congressional District on the Democratic ticket in 1934 and was reelected in 1936. During the four years he served in Washington, he was a member of the House Naval Affairs Committee.

Mr. Scott was a consistent new dealer; was a delegate from California to the Democratic National

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Highway progress model exhibited by Division of Highways on Treasure Island is 44 feet long and built to scale.

Exhibit Shows Highway Progress

AS A PARTICIPANT in the display now in progress on Treasure Island in San Francisco the California Division of Highways has chosen for the theme of its exhibit the thought expressed by its title, namely "A Quarter Century of Highway Progress."

Located in the eastern wing of the California Building is a highway diorama forty-four feet in length and five feet in width, constructed accurately to scale, which graphically portrays the tremendous growth and change which has taken place in highway facilities since the inception of the present State system of roads just a little over a quarter of a century ago.

Beginning with a section which depicts the general type and condition of roads in 1912, with their narrow, rutted soil surfaces—dusty in summer and muddy in winter—the model strives to show in a natural sequence of scenes the results of the effort of the highway engineer to meet the growth and expansion of the highway

transport his labors have been so largely responsible for creating.

For instance, the first soil road, winding and indirect in its alignment, terminates in a pavement, fifteen feet in width, representing the first effort to supply hard-surfaced, all-weather roads. As the mileage of this type of improvement grew, the ownership of an automobile, even of the vintage of 1913 and 1914, became a pleasure instead of a trying adventure.

The adjacent section, therefore, shows the next forward step in highway construction brought by the growth of traffic—the increasing of pavement widths from fifteen feet to twenty feet, as well as the improvement of many of the earlier roads to better standards of alignment.

The three-lane pavements and undivided four-lane pavements, which are still so largely a part of our present highway development, are next depicted and the final scene represents a section of ultra-modern divided "express" highway, with its

wide separation strip, its grade separations with intersecting major highways, and with paralleling service roads to preserve the "freeway" principle of its design.

An attempt has been made to visually illustrate the growth of traffic since 1912 by the number of automobiles shown using each section of the model.

The tremendous increase in the cost of constructing a mile of the early day roads as compared with the cost of constructing the complicated designs now necessary should also be plainly evident to any spectator who views the model.

(Continued on page 25)

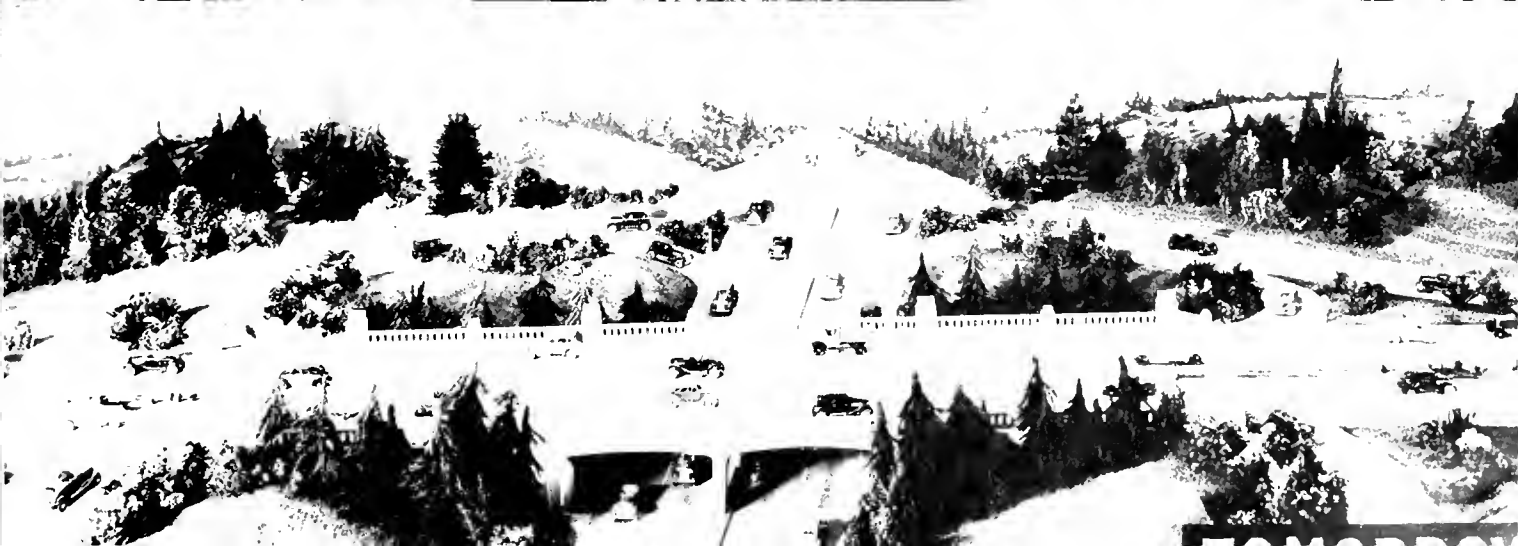
On the adjoining page the close up views of "A quarter century of highway progress" diorama model show in miniature the narrow, winding, rutted dirt roads of Yesterday, about 1912, followed by the improvement to wider paved surfaces and direct three and four-lane undivided highways of Today as developed into the ultra-modern divided express highways of Tomorrow with wide division strips, grade separations and parallel service roads.



YESTERDAY



TODAY



TOMORROW

Review of State Public Works Program by Director Clark

Director of Public Works Frank W. Clark, bearing the greetings of Governor Culbert L. Olson, delivered the following address at a joint session of delegates to the national conventions of the American Roadbuilders' Association, the Associated General Contractors and the Western Association of State Highway Officials in San Francisco on March 7th.

MR. CHAIRMAN, Honorable Mayor Rossi, Officers and Members of the American Roadbuilders' Association, The Associated General Contractors of America, and the Western Association of State Highway Officials:

I bring you the greetings of the Governor of the State of California, Culbert L. Olson. With the reconvening of our State Legislature the pressure of official duties upon the Governor has made it impossible for him personally to be present at this meeting. Accordingly, he requested that I represent him on this occasion and it is in line with his wishes that I extend, on his behalf a hearty welcome to each of you in attendance at this joint conclave of annual national meetings.

Those industries and those professions so well represented here by you men have been closely allied with and are largely responsible for the great and rapid progress which has been made in the general construction field during the first 38 years of this, the twentieth century, and I would like to take this opportunity to congratulate all of those who have played such an active part in this, the world's most outstanding period of progress.

ENGINEERING PHASES

The present-day modern building designed for maximum convenience and comfort for its occupants as well as for minimum maintenance expense for the benefit of its owner and in turn, also, for its occupants; the modern highway for comfortable, safe, high-speed automotive travel; and the impounding of water by the construction of dams for flood control, irrigation purposes, and power development, are the three phases of engineering and construction which are of greatest interest to



FRANK W. CLARK, Director of Public Works and Chairman of California Water Project Authority.

those in attendance at this joint meeting. As Director of Public Works of California, I am likewise most vitally interested in these same branches of the construction industry.

I am sure that we all agree that other than certain slight changes which are necessary in the design of buildings, both for commercial and domestic use, depending upon the climatic extremes which may be found in different localities, and certain minor provisions which may be thought to be necessary from an architectural standpoint because of the possibility of earthquake damage in certain well-advertised areas (quite remote, I assure you), there is a uni-

versal similarity in this phase of the industry.

HIGHWAY CONSTRUCTION

The same thing applies, generally speaking, in connection with road-building and highway construction throughout the 48 States of the Union.

In so far as highway construction is concerned, I am sure you gentlemen, connected with the construction industry as you are, will all agree, as do practically all visiting motorists to California, that our State Highway System compares favorably with that of any other in the country. Our only concern now is that because of the tremendous highway and road mileage under State supervision and maintenance, with the relatively small amount of gas tax money available per mile for new construction and State maintenance work, we are hard-pressed to keep up with the constantly increasing current requirements.

FEDERAL AID NEEDED

Continued and, in fact, increased Federal aid for California and, I believe, for all other States' construction, is of vital importance and I urge you gentlemen to lend your active support in aiding the States in this regard with their respective programs. In doing so, I am certain that the benefits which will accrue to our respective interests will pay handsome dividends upon the time and effort so invested by everyone.

Before leaving this subject of California highways I do want to take this opportunity to pay personal tribute to that fine gentleman and that nationally-known great engineer who has devoted so many years of his life to the interest of the State of California. He is largely responsible for that magnificent bridge which you

see spanning the bay, joining together San Francisco and Oakland. Not only its construction, but its very creation will long stand as an appropriate monument symbolizing his technical and engineering ability as well as his courage, his determination, and his well-earned outstanding reputation for integrity beyond question. You who know California highway development well, will know that I refer to none other than Charles H. Purcell.

CENTRAL VALLEY PROJECT

Gentlemen, there is now under construction in the northern part of our State a great dam which represents the initial unit of a project which, because of its size and character and its importance to the State of California and the construction industry, does, I trust, warrant my briefly outlining a few of its many unique and interesting features.

All of the activities of the State of California pertaining to water development and regulation are centered within its Division of Water Resources. This branch of the Department of Public Works began in 1921 a series of investigations and studies which resulted in our present plans for what we in California know as the Central Valley Project.

This project was originally designed as a State enterprise. It was adopted and authorized by State legislation enacted in 1933. At the present time, however, the Central Valley Project is a fully authorized and approved Federal reclamation undertaking. The construction work is under the supervision of the U. S. Bureau of Reclamation, of the Department of the Interior. The key unit of the project is known as the Shasta Dam and Power Plant, located on the upper Sacramento River near Redding. There are certain developments which are supplemental to this key unit, including the relocation of the Shasta Route of the Southern Pacific Railroad. This relocation of the railroad is necessitated in order to replace that portion of the present route which will be submerged with the completion of the reservoir.

One of the important conveyance units of the Central Valley Project is the Contra Costa Conduit, which will furnish water to a portion of Contra Costa County; this is likewise under construction at the present time.

An Epitome of Engineering Thoughts

. . . I, for one, am certainly in favor of seeing national money appropriated so that further development in this country can be carried on. . . .
Frank W. Clark, Director, California Department of Public Works.

. . . Efficient America has too long paid too high a price for this nightmare of traffic congestion
Murray D. Van Wagoner, president A.R.B.A.

. . . At the present time labor relations is the most exacting part of the contractor's job. It calls for patience and a certain abiding faith in human nature
E. P. Palmer, president A.G.C.

. . . It is foolish to attempt to build a substandard bridge
A. J. Mechem, senior bridge engineer, California highway department.

. . . An act of God is most anything that a contractor runs into that makes him overrun his time limit
R. M. Gillis, construction engineer, California highway department.

. . . Despite the 1938 reduction in highway accidents it is quite evident that night traffic is still abnormally hazardous
A.R.B.A. Committee on Highway Illumination.

. . . An appreciable subsidy is being paid by users of the state highway system to the users of roads not on the state highway system
A. I. MacLachlan, California Department of Public Works.

The cost of the project is now estimated at \$200,000,000. To date the Federal Government has appropriated an amount totaling about \$35,000,000, of which approximately \$8,000,000 already has been expended. Congress has granted an additional appropriation of \$10,000,000. The reason for this additional appropriation is based on the fact that more funds can be used to advantage. With the added appropriation, construction of the project can be speeded during the coming year.

There are other units of the project on which contracts may be let during the coming year. These will include the Friant Dam, to be constructed on the San Joaquin River, together with several conveyance units which will include the Madera-Friant-Kern canals, the San Joaquin Pumping System and the Delta Cross Channel.

The two largest streams in the State of California are the Sacramento and San Joaquin Rivers. The Central Valley Project contemplates the coordinated development of these two rivers. It is our purpose to conserve, regulate and distribute the flow of these rivers in order that urgently needed water supplies for existing agricultural, industrial and municipal development in the San Joaquin and Sacramento valleys and the upper

San Francisco Bay regions may be adequately provided.

SALINITY CONTROL

As I have already indicated to you, the major unit of this project is the Shasta Reservoir on the Upper Sacramento River. A massive concrete dam, which will rise 500 feet above the present stream level, will regulate the river, including its flood flows. It will provide a reservoir with a storage capacity of 4,500,000 acre feet. Upon its release from the reservoir, the water will flow down the Sacramento River, maintaining adequate depths for navigation, and at the same time it will furnish an ample supply of water for irrigation and for municipal and industrial use in the fertile delta regions along the Sacramento and San Joaquin rivers. It will at the same time prevent the intrusion of salt waters from the bay into the delta channels.

In past years this intrusion of salt waters has been the cause of substantial loss in crops and has threatened the destruction of productivity within these regions.

Adequate water supplies will likewise be made available in the delta channels for various uses in the nearby upper San Francisco Bay region, as well as in the San Joaquin Valley.

conduits to carry the supplies to these areas will be provided.

FRIANT RESERVOIR AND CANALS

Canals, together with a series of pumping plants, will convey the water from the delta channels to the San Joaquin Valley, a distance of one hundred and fifty miles. In accomplishing this conveyance the water will be lifted to an elevation of 160 feet above sea level. The water thus conveyed will replace the waters of the San Joaquin River, which in the past have been used for irrigation purposes in the northern San Joaquin Valley. The entire flow of the San Joaquin River will be regulated by means of the Friant Reservoir, which is the second storage unit of the Central Valley Project. This will enable the lower San Joaquin Valley to be properly irrigated by the water from the river, which previously has been used for irrigation in the northern San Joaquin Valley.

I should like to emphasize that although the Central Valley Project is being constructed by the Federal Government, the State has a most vital interest in its completion. Since the inception of work upon the project by the Bureau of Reclamation, which began in 1935, the State of California has cooperated and assisted materially in the carrying out of final studies and investigations leading to the preparation and completion of contract plans.

PUBLIC DISTRIBUTION OF POWER

The new State administration, since it took office at the beginning of this year, has as one of its most important objectives the initiation of an energetic program for the public distribution of the hydro-electric power and water which will immediately be made available through the medium of the Central Valley Project. In his inaugural address delivered to the Senate and Assembly in joint session on January 2, this year, Governor Olson said:

"The construction of the great Shasta Dam of the Central Valley Project was instituted as a Federal Government project. The Federal government looks to this State and to its subdivisions to be prepared to receive the benefits of this project, not only in the equitable distribution of its water, but in the utilization of its hydro-electric power, through public agencies. It shall be the purpose of this administration to promote the

means for public ownership and operation of plants and distributive facilities for the distribution of this electric power for the people at cost."

GOVERNOR OLSON'S PROGRAM

In furtherance of this announced policy, Governor Olson already has submitted to Secretary of the Interior Ickes a program which deals with the operation of the Central Valley Project. This program contains the following proposals:

(1) That the State, through the Water Project Authority, which is the agency created by the Central Valley Project Act of 1933 for the purpose of administering the project, take over the operation and maintenance of the entire project upon its completion. That the State enter into a contract with the Federal Government providing for the repayment of reimbursable costs of the project by means of revenues secured from the sale of water and power through supplemental contracts to be negotiated by the Water Project Authority with public and other agencies.

(2) That the State prepare plans and immediately undertake the construction of a steam electric power plant in the vicinity of Antioch, Contra Costa County, together with necessary secondary transmission and distribution facilities which will provide an adequate program for the disposal of Central Valley power to public districts before the power from the Shasta Dam becomes available in order to make an early start in the creation of a market for the power to be eventually derived out of the Shasta Project.

(3) That the State directs and assist in the organization of public districts to purchase water and power, and that the State proceed with the enactment of necessary enabling legislation to carry out the program.

SPEED ON PROJECT URGED

In a recent conference with Secretary Ickes, Governor Olson and I emphasized the necessity, as well as the economy, of speeding up construction work on the project. We explained that an early completion of the entire project was most essential in order to stop further abandonment of developed lands due to shortage of water.

Let me add that bills already have been introduced in our State Legislature to provide the necessary legal machinery for putting into effect the

policy and program of the Governor. This policy and program will be vigorously pursued in order that the people of the State may receive the maximum benefits of the project by obtaining the available water and power at minimum costs. So much for the Central Valley Project.

FLOOD DAMAGES

In 1937 and 1938 flood damages approximating \$150,000,000 were sustained in this State. The control of angry waters has become a major problem in California. We must prevent the recurrence of loss of life and property from floods with attendant disruption of transportation, communication and business facilities. It is our purpose also to conserve, as far as possible, these waters which for many years have been rolling wastefully to the sea during the flood season, but which in the summer and fall are urgently needed for irrigation and other necessary purposes.

The Federal Government and the State of California are working closely together under a well-organized program to meet this situation, but here again let me urge you gentlemen who are interested in all phases of the construction industry to lend your support in Washington for further Federal aid on all public works projects.

PROBLEMS OF INSTITUTIONS

I will now briefly touch upon another phase of the State administration program which I am sure will be of interest to all of you here assembled. Governor Olson recognizes the ever-prevailing overcrowded conditions of our State institutions and the very serious building needs which this overcrowded condition necessitates. Accordingly, the Governor has presented to the 1939 State Legislature for approval, a State building construction program for the new biennium amounting to approximately seven million dollars.

In addition to his budget provisions, Governor Olson has also released for immediate building construction at State institutions over the entire State, the sum of three million dollars which was unexpended and available from previous legislative appropriation.

In closing I would like to further stress one matter which, I believe, is of great importance to this entire assemblage. We have all heard a great

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Group of delegates at annual meeting of Western State Highway officials in San Francisco March 6th to 9th.

Western State Highway Officials Meet

THE annual meeting of the Western Association of State Highway Officials was held at San Francisco March 6 to 9, inclusive. The meeting was purposely scheduled at that time so that it might run concurrently with the national convention of the American Road Builders' Association and the national convention of the Associated General Contractors.

The W. A. S. H. O. convention was well attended, there being 287 registrations; and with the exception of the States of Idaho and Nevada, all of the twelve western states were represented. In spite of the fact that last minute changes had to be made in the program, the papers presented were unusually well received, and the discussions that resulted brought forth many worth-while opinions.

At the opening session on Monday, March 6, the delegates were welcomed by C. H. Purcell, State Highway Engineer, representing Director of Public Works Frank W. Clark. Also at the opening session, papers were presented by James Davis, Assistant Director of Highways of the State of Washington, and Charles Upham,

Engineer-Director of the American Road Builders Association.

On Tuesday morning the session was devoted entirely to a discussion of "Enforcing Time Limits on State Highway Contracts."

On Tuesday afternoon, there was a joint meeting of the W. A. S. H. O., American Road Builders' Association and Associated General Contractors. This large joint session was welcomed to California by the State Director of Public Works Frank W. Clark representing Governor Culbert L. Olson. Mr. Clark's address (published elsewhere in this issue) was followed by addresses given by C. H. Purcell, California State Highway Engineer; Murray D. Van Wagoner, President A. R. B. A.; C. D. Vail, President W. A. S. H. O.; E. P. Palmer, President A. G. C.; and L. I. Hewes, Deputy Chief Engineer, U. S. Bureau Public Roads.

On Wednesday the delegates spent the day at the Road Equipment Show in the civic auditorium.

On Thursday morning the meeting was devoted to a discussion of "Soil Studies" led by T. E. Stanton, Materials and Research Engineer of the

California Division of Highways. In addition, the program committee was fortunate enough to get Major Robert B. Brooks, Chairman of the committee on Highway Intersections and Grade Crossing Elimination of the A. R. B. A., to give the convention a synopsis of the report of his committee.

The business session closed Thursday noon, March 9, with the adoption of resolutions and election of officers for the ensuing year.

RESOLUTIONS PASSED

The resolutions passed covered:

1. Resolution of thanks to the City of San Francisco, the Golden Gate International Exposition, the Fairmont Hotel, and the California Division of Highways for their respective parts in making the convention a success.

2. Authorizing the executive committee to cooperate to the fullest extent with the national organization in making the arrangements for the anniversary meeting to be held at Richmond, Virginia, in October.

3. Recommending that the cooperation committee of the American As-

(Continued on page 28)



Shovels and heavy trucks working on excavation of new Mountain Springs grade. Old grade and look-out tower seen in background.

Mtn. Springs Grade Problems

by E. E. WALLACE, District Engineer

SINCE construction was started in October on the upper portion of the Mountain Springs Grade, the contractor has made very good progress on this difficult piece of highway construction. The use of modern highway equipment and methods, and the efficient handling of the job by Contractor Vinnell is responsible for the progress to date.

In the development of both railway and highway transportation between the agricultural areas of the Imperial Valley, southwestern Arizona and San Diego's favorable shipping and harbor facilities, the mountain range along the San Diego-Imperial counties border has always been the major barrier. In this day of modern engineering and construction accomplishments, the railroad location and construction down Carriso Gorge, surmounting the Mountain Springs barrier, remains an outstanding monument to the men who built it.

The work of highway location and construction has been no less dif-

ficult than that of the railway. In 1914 the State took up the improvement of this section where the counties of Imperial and San Diego left off. Since that date and including the present improvement the State will have expended for construction a total of \$1,165,900 on the section of highway between Coyote Wells and the top of the grade.

The present construction traverses some of the most rugged portions of the Mountain Springs barrier and involves many problems of engineering and construction not found in the usual project.

The contract item of roadway excavation involves the movement of approximately 100,000 cubic yards per mile. The excavation consists, for the most part, of granite rock, and in consolidating this rock into the embankment sections, it is proposed to use 13,000,000 gallons of water. This large amount of water will be used to flush the line material down through the voids in the rock, and thus consolidate the embankments to prevent future settlement.

The contractor has installed a water line, and is pumping water from Jacumba, five and a half miles westerly from the project.

The roadway section must be constructed through a section of high, steep, rocky slopes, and in order to retain the embankment, and to prevent the fill material from spilling far down these slopes, metal cribbing is to be installed.

On completion of the grading, the roadway will be blanketed with imported borrow, and the surface treated with liquid asphalt by the road-mix surface method. Later, as funds become available, a higher type surfacing will be placed.

On March 15, 1939, Contractor Vinnell had completed 64 per cent of the contract, with only approximately 56 per cent of his contract time elapsed, and without unforeseen difficulties, completion of the job considerably in advance of the time limit is anticipated.

The new location will involve 952 degrees less curvature, with complete elimination of 16 of the

curves on the old alignment. The minimum radius of curvature is 600 feet, as compared with 126 feet radius at present, and a 6 per cent maximum grade where a 7.12 per cent maximum existed previously. The new roadway will be 36 feet wide.

Because of a long grade and very crooked alignment, the passing of trucks and vehicles on this narrow mountain highway is hazardous and in places impossible.

The Mountain Springs Grade section of U. S. Highway 80 has gradually developed from an old wagon stage road, rising from the desert below sea level to the summit of the Coast Range. It extends from El Centro, 44 feet below sea level, to an elevation of 3240 feet at the summit near the county line.

The most westerly portion traverses some of the roughest terrain in this range of mountains. It rises quite abruptly from the point known as Mountain Springs to the most westerly point on the county line known as Boulder Park.

U. S. Highway 80 is one of the main transcontinental arterials, extending through the southern part of the United States from ocean to ocean. In addition to being a route that is open to travel throughout the entire year, the westerly portion is of extreme importance in the development of Imperial and San Diego counties, because it is the connecting link between the great agricultural section of the Imperial Valley, the county and city of San Diego, and San Diego harbor.

On October 18, 1938, the first Colorado River water was turned into the practically completed All-American Canal, which will develop the irrigable agricultural areas in Imperial Valley and provide irrigation for over a million acres of fertile lands.

Letter of Appreciation from Berkeley

January 24, 1939.

California Highways and
Public Works.
Sacramento, California.

Gentlemen:

Will you please put me on your mailing list for "California Highways and Public Works," as I hope to receive this valuable magazine every month. Mailing address: 944 San Benito Road, Berkeley, Calif.

Yours very truly,

C. H. THOMAS,
Asst. Supt. of Streets.



Construction scene on Mountain Springs grade relocation involving excavation of approximately 100,000 cubic yards per mile, mostly granite rock. 13,000,000 gallons of water will be required in consolidating this rock into embankment sections.

How "Speed Zoning" Safeguards Traffic; Reduces Accidents

By H. L. KILE, Assistant Safety Engineer

The following article is a paper read by Mr. Kile at the annual convention of the Western Association of State Highway Officials held in San Francisco March 6th to 9th inclusive

SPEED "excessive for conditions" is one of the most common causes reported as contributing to the occurrence of traffic accidents. Qualified in this manner, there is little either of opportunity or desire for anyone to dispute such a charge. It is universally agreed that a driver should at all times properly control the speed of his vehicle. But how to best assure that this will be done is a far different matter and one upon which ready agreement is not so easily reached.

The most common methods of attempting to legally cope with the hazard inherent in speed are to either set an upper limit in miles per hour which must not be exceeded, or to simply state that speed must at all times be "reasonable and prudent."

Either of these situations leaves much to be desired. What we all want, individually as drivers, passengers, or pedestrians, or collectively as society, is to derive the utmost in usefulness, convenience and pleasure from our streets, highways, and motor vehicles; and this can not be had so long as numerous accidents occur and large opportunity for their continuance exists.

BLANKET LIMIT IMPRACTICAL

So far as setting an upper or maximum speed is concerned, no blanket limit in miles-per-hour can be satisfactory for all portions of a highway system. It is equally unsatisfactory to all concerned to merely say to drivers or pedestrians: You must be "reasonable and prudent." Such a course is of no help to the normal individual. He already wants very much *not* to be involved in accident.

As for the small minority that may be indifferent or actually criminal in their tendencies, the difficulties in en-

forcing such a law are very great. Enforcement officers have no yardstick except such as they may themselves devise, one which they have no assurance will be accepted as correct.

The blanket speed limits are of little help to a driver and may on occasion become just the reverse. While no one can legally claim relief from the responsibility to use due care at all times, drivers may unconsciously assume that the maximum in miles per hour is safe when such speed is not warranted. The blanket speed limit similarly works to the disadvantage of the enforcement agencies in their efforts to curb the minority who flaunt a disregard for care and then advance as a justification the fact that they were not exceeding the maximum permitted by law.

SITUATION IS COMPLEX

The situations and conditions encountered in modern highway traffic are so complex as to require that the driver be given every possible assistance in order to avoid unsuspected hazards. That such help is needed has long been recognized and provision made to specifically call attention to railroad crossings, blind intersections, restricted clearance, substandard bridges, etc. However, in the matter of "speed"—the one thing which in some degree contributes toward practically every motor vehicle accident—we have for the most part been content to treat it in only the most general way, a state-wide maximum miles-per-hour supplemented by a certain few further restrictions for so-called "residence" or "business districts."

Through necessity or otherwise we have failed to base speed regulation upon the only acceptable or enforceable formula for any legislation—that of reasonableness. The most likely explanation for this situation is that no

method for the determination of what is a reasonable speed has enlisted sufficient confidence for its support by the public.

MANY FACTORS INVOLVED

"Speed" is entirely a relative term. Herein lies the chief difficulty toward expressing its limits in miles-per-hour. The varying influence that it may have when related to the many other contributing traffic factors can only be determined by the intelligent study and analysis of the specific problems that demand solution. It is by no means an easy or a simple task.

As we all know, highway traffic is no longer a simple matter, of concern to no one but a lone driver on his own road. It has become a matter of the widest importance and its complexity has grown proportionately, not only because of the immense increase in number of vehicle units but also by reason of the widespread social effect of this means of travel.

This has naturally led to specialized study of those things that particularly concern or relate to traffic, its behavior, and the promotion of whatever may be of benefit to it. And since "speed" is of elemental interest to traffic, this subject has received a peculiarly large share of attention.

One definite result of these studies has been the acceptance in certain States of "Speed Zoning" as one logical and promising method of increasing the traffic value of our highways. It is well to emphasize that the object sought is not to retard but, on the contrary, to facilitate the free movement of traffic. "Less haste, faster." "The more hurry the less speed." "Haste" and "hurry" are what must be eliminated in order that the real value of "speed" may be conserved.

It is the recognition on the part of the traffic engineer of his responsi-

bility to place at the disposal of the average driver all the knowledge which he has or can acquire through his special training and experience, to the end that this same average driver may be assured of a *completed* journey within the shortest reasonable limit of time.

As defined in a recent special committee report to the National Safety Council, "Speed zoning is the application of special posted speed limits to sections of roadway, provided that the numerical values of these special limits have been determined after engineering investigation of traffic and physical conditions of these roadway sections.

"Speed zoning consists of (1) the identification of locations or sections where there are unusual conditions or where changes are required in normal driving speeds from those at adjacent locations, (2) traffic engineering study of conditions at these locations to determine maximum values of safe speed for average weather and traffic conditions, (3) posting these values, to inform drivers of the safe speeds and as a guide in the enforcement program, and (4) enforcement of these limits to the extent possible with available police personnel. All four of these steps are necessary in a speed zoning program."

DEMANDS REASONABLE BASIS

It is immediately seen that such a program is the very opposite of "arbitrary"; it demands that there be a logical, reasonable basis in each instance, something which both public and courts will be inclined to accept with confidence.

Quite obviously, speed zoning in the manner described must be accomplished through administrative action rather than by numerous legislative acts. Existing traffic laws in many states provide for the delegation of such authority to a State department. Once locations are established and properly posted, speeds in excess of zoned limits are evidence of violation.

In states where no provision has been made for the delegation of such authority to an administrative department, the success of speed zoning if attempted at all must depend upon the voluntary observance of motorists and whatever additional weight such zoning may have with the court in those cases brought before it under the basic speed law requiring reasonableness and prudence.

In its report previously referred to, the National Safety Council Committee on Speed and Accidents sets forth very comprehensively and in much detail the record of experience of those states where speed zoning has been used. Eighteen states are listed as having speed zones at various locations on their state highways. Several others where "speed zoning" in the accepted meaning of the term has not as yet been established do, however, make wide use of state-speed indications for curves.

Michigan, in addition to the regular types of speed zones, has also



Warning signs tell safe driving speed for curve zones on California Highways

established "traffic control zones." These zones are governed by special traffic regulations which cover not alone the speed but certain other items of movement, such as no passing, and no crossing of center line. The intent in all cases is to expedite and safeguard the use of the highway.

The natural concern both of those who have instituted this program and of many others among us who are in full accord with the logic of its approach, is to measure its effectiveness in actual operation. Happily, re-

search in this regard by the Safety Council committee disclosed general agreement among motorists, State officials, and factual records of before-and-after conditions, that speed zoning properly applied is of distinct benefit to highway traffic.

The motorists favor it because it tells them when speed reductions are required for safety and also tells them where higher speeds can be permitted with safety. Factual information, while still inadequate and lacking in uniformity, as would be expected on account of varying methods and conditions in the several states, nevertheless definitely shows that in the main vehicles travel at a more uniform speed after speed zones are established, and the percentage of those exceeding the zone limit by more than five miles per hour is reduced.

"CONTROL ZONE" SUCCESS

In most instances there has not yet been sufficient elapsed time for a satisfactory comparison of accident experience with respect to strictly "speed zone" establishments, but the accident record on Michigan's 28-mile "traffic control zone" on U. S. 24 and 25 south of Detroit is particularly encouraging. As noted above, zones of this character include along with "speed zoning" certain additional restrictions forbidding vehicles to cross the center line and requiring them to stay in the outside lane except when passing.

Collision accidents were reduced more than 75 per cent and fatalities about 70 per cent. A similar 6½-mile zone on U. S. 10 south of Saginaw is reported as showing a reduction in fatalities from 12 in 1937 to only one in 1938, the first year after zoning.

There is no intention to convey the idea that speed zoning attempts have been an unqualified success in all instances. This is not true; but where unsatisfactory results have obtained, it has been generally admitted that failure was not due to any inherent fallacy of principle but because insufficient care was used in selection, establishment, or enforcement.

REQUIRES ENGINEERING KNOWLEDGE

These are matters for engineering determination and if neglected or inadequately covered we have little right to hope for, and just as little chance to achieve, worthwhile results. We must know through accident and traffic records where the high points

(Continued on page 27)

Unusual Drainage Features on the Angeles Crest Highway

By M. L. BAUDERS, Resident Engineer

THE storm of March, 1938, that ravished southern California, destroyed sections of the Angeles Crest Highway in Los Angeles County and proved the necessity of providing drainage facilities far greater than heretofore deemed necessary.

In a country where the normal rainfall is approximately fifteen inches is found a section where the precipitation is in excess of forty inches. This is the Mount Wilson area of the San Gabriel range and the country just beyond—a bulwark across the path of winter storms.

Brush, covering the slopes, did not prove adequate in holding back the torrential rains that fell. Rain-soaked brush, earth and rock flowed down the precipitous mountainsides in masses to overwhelm the highway clinging there, halfway down the slopes.

FILLS WASHED OUT

Every small depression in the mountain slopes spewed down an unbelievable amount of debris, clogging drop inlets and filling to overflowing the sumps behind the thorough-fills. With no outlets the accumulated surface drainage soon overflowed the berms. Many fill-slopes were badly eroded and some of the fills completely washed out.

On an inspection trip immediately following the storm, it was very evident from the amount of debris washed from the mountain slopes onto the highway that some changes had to be made in drainage designs. With this in mind, a study was made to coordinate installation of redesigned drainage structures with the reconstruction of the damaged highway.

Several possibilities were readily apparent, such as larger culverts placed through fills completely gone, revamped inlets to culverts, large spillways through daylighted points and, in some instances, large ditches or turnouts starting at the lower end

of thorough-cuts out to a point beyond the toe of the fill.

The reason for the loss of the large fills in most cases could be traced directly to the flood water flowing over the fills. Large spillways strategically placed to catch this overflow would insure against such loss in the future. Such spillways would also function as down drains to carry the excessive debris and material washed from slides. In many cases where culverts were plugged, a spillway of this kind would have saved the embankments.

On side-hill fills, of such length as to warrant down-drains to take care of surface drainage, especially constructed pipe culverts were installed down the face of the slopes. As flexibility was necessary, due to the instability of the fill material, pipes were made up along the design of the well-known "elephant trunk" concrete chute.

The entrance diameter of these pipes is 30 inches, tapering to 18 inches in a length of 40 feet. From there 12-foot sections of 18-inch pipe, belled at one end to 19 inches, continue to the bottom of the slope. Cables anchored in concrete at the top are used to hold the pipe in place. Grouted rock headwalls form the entrances. Vertical pipe grills, timber-capped and painted white for visibility, are installed across the entrances.

DROP INLETS REMODELED

Standard drop inlets were remodeled, leaving two sides in place to form "L" headwalls. Ramp-like entrances, 20 feet long and parallel to the roadway, were constructed, with rubble walls to support the shoulders. The new headwalls, as well as the old, were designed with bell-type entrances in order to minimize entrance loss.

Spillways were constructed where thorough-cuts were daylighted to obtain borrow for reconstruction of

embankment fills. On the large areas suitable for parking of automobiles the spillways were built to one side. The spillway entrances were made by sloping the day-lighted area down on a 15 per cent grade from the gutterline. Entrance widths at the gutterline are 30 to 40 feet while lengths vary from 30 to 60 feet, tapering to the width of the spillway ditch.

The spillway ditches were excavated by hand and are 3 to 6 feet wide in the bottom, 2½ to 3 feet deep and 200 to 300 feet long, carrying the flow of water beyond the toe of the fill-embankment.

DITCHES PAVED WITH BLOCKS

Many of the spillway ditches had to be paved to prevent erosion. Rock grouting proved to be such a slow task that precast blocks were made and cemented into place. The blocks are 4 by 18 by 36 inches. With the aid of a power-winch and an especially constructed car on tracks it was possible for a foreman and seven men to place 30 blocks a day.

Casting of the concrete blocks was done on a nearby parking area. It was possible to cast 20 blocks at a time. A foreman and seven men were able to cast approximately 80 blocks a day. The forms used were 4 x 4-inch timbers staked to the ground in the form of a grid. Chamfer-strips were nailed on the center of the form timbers to provide a "V" shaped groove around the edge of the blocks to make a lock joint when the blocks were grouted into place.

One six-foot spillway, just completed, is located in the lowest part of a vertical curve and near one end of a 250-foot radius curve. The grades were so designed that the lowest part of the vertical curve centered on a small day-lighted ridge at one side of the fill-embankment.

A culvert of corrugated metal pipe 60 inches in diameter, placed to drain

(Continued on page 27)



Drainage features of Angeles Crest Highway in Los Angeles County. Upper left—general view of terrain with spillway entrance in foreground. Below—grouted rock channel entrance to paved spillway. Upper right—paved spillway and planted slopes. Below—spillway paved with 18 by 36 inch concrete blocks.

Grade Separation Project at University Avenue in Berkeley

By E. H. McBroom, Associate Bridge Engineer

BIDS were opened on March 1, 1939, and a contract has been awarded to the contracting firm of Heafey-Moore Company, Fredrickson - Watson Construction Company, of Oakland, for the construction of a crossing over the Southern Pacific Railroad tracks at University Avenue in Berkeley.

The necessity for a separation of street and railroad grades at this crossing may readily be seen from the

which the city of Berkeley estimates at fifty-six per day.

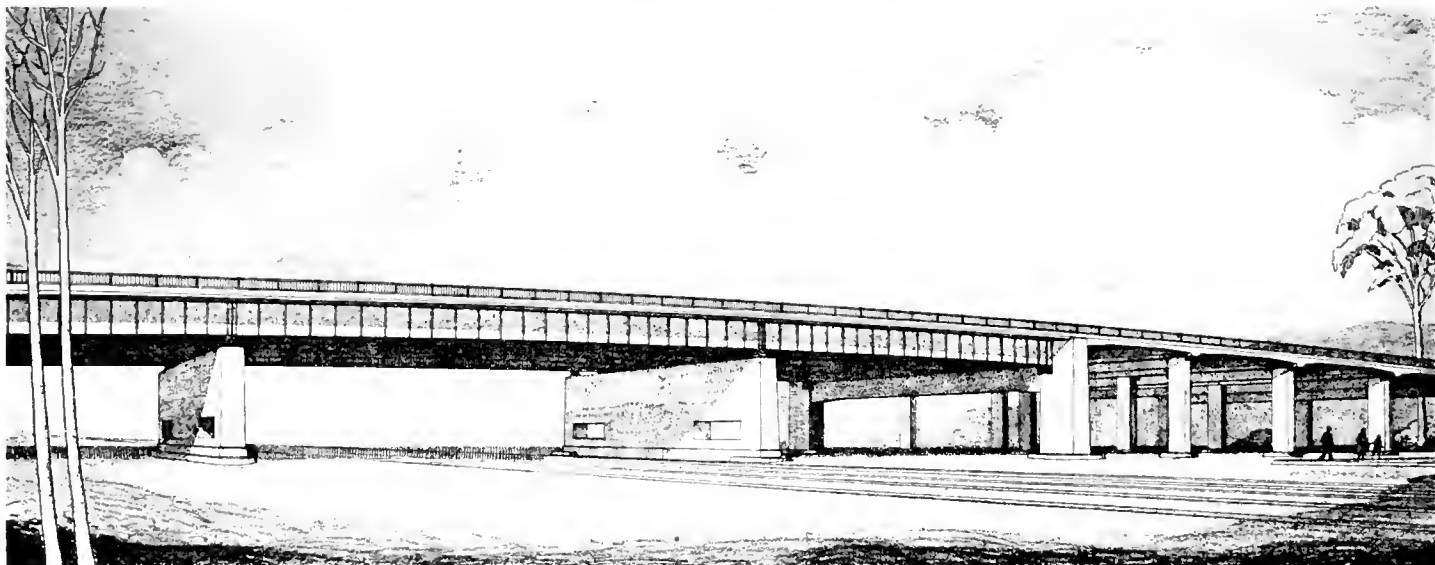
University Avenue is the main arterial connection between the East Shore Highway and the University of California Stadium, and carries a large part of the traffic to and from the football games.

SUBWAY FOUND IMPRACTICABLE

During the preliminary studies some consideration was given to the

cal clearance of 22 feet 6 inches. The main spans are supported by massive concrete piers and the concrete spans by three-column bents so placed that all intervening cross streets are free of obstructions. Five hundred fifty-four concrete piles will carry the loads down through forty feet of sand and mud to a firm foundation.

The new right-of-way is 130 feet in width east of the railroad, which gives ample room for a 6-foot side-



This massive steel and concrete structure will carry daily average of 3000 motor vehicles above 6 railroad tracks used by 42 trains.

following traffic census figures for this site. The average daily vehicular traffic along University Avenue amounts to 3000 cars and trucks, and the train movements consist of 34 passenger trains and 8 regularly scheduled freight trains per day.

The Berkeley depot of the railroad is situated at University Avenue and Third Street, which is a regular stop for practically all passenger trains. The passenger trains block the crossing from one to several minutes each, and the slow moving freight trains from two to four minutes each. In addition to these regularly scheduled trains, there are switching movements

idea of constructing a subway. Because of the high level of the ground water, however, it soon became apparent that a subway was not practicable from an economical standpoint. The presence of a nine-foot diameter sewer in the center of University Avenue was also a contributing factor in the selection of the overhead type.

The new bridge will consist of one 118-foot 6-inch and two 85-foot 6-inch steel girder spans and 15 reinforced-concrete slab spans varying in length from 33 feet 6 inches to 48 feet. The 118-foot steel girder span crosses over six tracks with a minimum verti-

walk and a 28-foot roadway at street level along each side of the new bridge. This provides easy access to the Berkeley depot and other abutting property.

CARRIES DIVIDED HIGHWAY

The new bridge is designed for two 25-foot roadways, separated by a four-foot center dividing strip. A steel hand railing made up of square tubular sections will extend along the entire length on each side.

The aesthetic features tend to accentuate horizontal lines and to provide a pleasing appearance by the

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Bert L. Vaughn

(Continued from page 9)

he has also been manager of the water works at Winterhaven, a town situated on Highway 80 near the Arizona border.

Mr. Vaughn has three sons, the eldest, Tyrone, being now assistant manager of Jacumba. Richard, his second son recently graduated from the Ohio State University and began the practice of law in San Diego. His youngest son, Don, is still attending school.

Referring to his appointment as member of the California Highway Commission Mr. Vaughn said: "I appreciate the honor thus conferred upon me, as I do also the opportunity to serve the people of this great State under the able guidance of Governor Culbert L. Olson and Hon. Frank W. Clark, Director of the Department of Public Works. At the same time I am conscious of the vital responsibility involved and shall sincerely endeavor to discharge my duties in such a manner as to deserve the approval of the people of the State and to justify the confidence of the administration."

Lawrence Barrett

(Continued from page 8)

Born in San Francisco April 21, 1891, Larry Barrett was educated in the public schools of that city and at St. Ignatius College, now the University of San Francisco. He was one of eleven children of John and Margaret McMahon Barrett. His father was in the construction business and for six years after completing his school courses Mr. Barrett was engaged with him in the building industry.

When the United States entered the World War, Larry Barrett went to Camp Lewis with the 91st Division and went overseas with that famous fighting outfit. He saw active service in France and Belgium with the 347th Field Artillery and went into Germany with the Army of Occupation.

Returning to San Francisco after the war, Mr. Barrett entered the garage business and steadily enlarged his properties. On February 3, 1921, he married Mary Elizabeth Kerr of San Francisco. They have six children, three girls and three boys.

L. G. Hitchcock

(Continued from page 8)

University. Mr. Hitchcock majored in law. Leaving Stanford in December, 1925, he entered the employ of a nationally known tire and rubber company.

Mr. Hitchcock was married to Miss Irma E. Walker on March 3, 1927. He had set his heart upon practicing law and in 1931 he resumed his studies of Blackstone, passed his bar examination and has engaged in the practice of law since then in San Francisco and in Santa Rosa.

During his residence in Santa Rosa, Mr. Hitchcock has been active in the civic affairs of that city. He is Commander of Theodore Roosevelt Post No. 21, American Legion, Esteemed Leading Knight of Elks Lodge 646 and a member of the Grange, Eagles and Lions Club. He is a member of the Democratic County Central Committee of Sonoma.

Mr. and Mrs. Hitchcock have two children, James, aged 9, and Janet, aged 4. The new commissioner has, by his own count, several hobbies—his youngsters, his interest in highways, working in his garden and golf.

Iener W. Nielsen

(Continued from page 9)

in Fresno civic organizations. He has been a member of the Fresno Democratic County Central Committee for fourteen years and served as vice chairman and regional director of the Democratic State Central Committee.

Mr. Nielsen resides at 1487 Echo avenue, Fresno.

They make their home at 70 Clark Drive, San Mateo Park.

Built in proportion to his 6 feet, 3 inches of height, Mr. Barrett, before the war, was amateur heavyweight boxer of the Olympic Club of San Francisco and a member of the club's swimming team. As a young man, he played semi-pro league baseball. He is a member of several San Francisco clubs and civic organizations and of Zane-Irwin Post of the American Legion. He is vice president of the Garage Owners' Association and a director of other large mercantile and real estate interests.

Byron N. Scott

(Continued from page 9)

Convention in Philadelphia in 1936, and was unanimously elected permanent chairman of the Democratic State Convention in Sacramento in 1938.

In Washington he put through Congress legislation for flood control on the Los Angeles and San Gabriel rivers. He was an active leader in the drive for revision of the present Neutrality Act, which is now being urged by the President.

His resolution to investigate the American Medical Association was the prelude to the Federal grand jury indictment of that organization and a part of the impetus given to the present plans of the State Medical Society to give to the people of California low cost medical attention.

Because of his interest in world affairs and his active efforts for world peace, Mr. Scott was invited to attend the International Peace Campaign Conference held in the early fall of 1938.

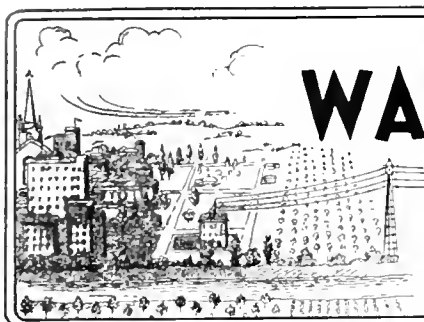
Mr. Scott is 36 years old and married. He is a Mason, a Sciot, a member of the Sigma Alpha Epsilon fraternity, the Exchange Club of Long Beach, and the Eagles Lodge.

After one month as secretary of the commission Mr. Scott has this to say:

"I think there is a lot that a man in this office can do, and I intend to do it to the best of my ability. The people of this State asked Culbert L. Olson to bring to Sacramento the philosophy that the State government should function for the benefit of all of the people and not for just a chosen few. That, I know, is also the conviction of the Director of Public Works, Frank W. Clark. I feel right at home in this environment and intend to do what I can to assist in the realization of this philosophy in the State Highway Department."

HIGHWAY OFFICIALS TO CELEBRATE

The American Association of State Highway Officials announces celebration of its twenty-fifth birthday which will be commemorated during the second week of October, 1939, in connection with the regular annual meeting of the association to be held at Richmond, Virginia.



DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

March, 1939

EDWARD HYATT, State Engineer



ACTIVITIES provided for in a supplemental agreement between the United States and the Water Project Authority of the State of California in connection with the preparation of data for the Central Valley Project were continued. The activities have included field surveys in connection with the preparation of topographic maps of lands along the San Joaquin River between Friant and Gravelly Ford and between the mouth of the Merced River and the San Joaquin delta. Office work has included the preparation of data for reports on the acquisition of and a plan of exchange for waters of the San Joaquin River claimed by property owners east of the San Joaquin River in Merced County and south of the San Joaquin River in Fresno County.

Work has also included the preparation of reports on the surface water supplies of lands adjacent to the San Joaquin River between Friant and the mouth of the Merced River, underground water supplies of lands adjacent to the river between Friant and Gravelly Ford and the classification of land and utilization of water on properties adjacent to the San Joaquin River between Friant and Gravelly Ford.

In connection with studies of water rights, topographic and soil survey, maps are being prepared of lands between Friant and Gravelly Ford and between the mouth of the Merced River and the San Joaquin delta.

Negotiations were continued with public utility companies for the relocation of power and communication facilities for the completed Central Valley Project and for temporary relocations necessitated by construction activities.

SPECIAL INVESTIGATIONS

Flood Damage Repairs

Investigations and the preparation of re-

ports on work for which applications have been made for allotments from the State emergency fund for the restoration of property, levees, flood control works, county roads and bridges damaged by the floods of the 1937-38 winter season, were continued and 14 reports and recommendations were submitted to the Director of Finance pursuant to his instructions. Thirty-eight allocations were made by the Director of Finance for flood damage repair work during the month. The total amount of outstanding allocations at the end of the month was \$4,369,200. The Division of Water Resources has performed or is performing some of the work for which these allocations were made and the remainder is being done by the applicants under 127 contracts entered into with the Department of Public Works. These contracts cover work which will cost \$3,326,000, some of which has already been completed.

The division has carried on by force account the repair of the damaged units of the Sacramento River flood control project for which \$150,000 was made available out of the emergency fund. Approximately \$106,000 has been expended to date.

With our own force and equipment, piles have been driven and caps set for three bridges across the borrow pit of the east levee of the Sutter By-pass.

Cooperative Flood Control

A comprehensive survey being conducted jointly by the Division of Water Resources, the U. S. War Department and U. S. Department of Interior, Geological Survey, covering the compilation and analyses of flood data on the record-breaking floods of 1937-38 winter season was conducted and reports are under preparation.

FLOOD CONTROL AND RECLAMATION

Owing to the unusual dry season, the drainage pumping plants on the Sacramento project have been operated only a few hours. The dry season has necessitated the commencement of irrigation operations much earlier than usual, and the opening of the Butte Slough tide gates has made it possible to divert sufficient water into the by-pass channels.

The rivers of the project are now at a very low stage. A short and mild storm brought the Sacramento River up so that water flowed out of the Colusa and Tisdale weirs for a few hours, but otherwise all water has been confined to the river channels. The season is now so far advanced that there is little prospect for floods in the Sacramento River system.

IRRIGATION DISTRICTS AND DISTRICTS SECURITIES COMMISSION

The Irrigation Districts Association of California held its biannual meeting in Sacramento during the month for consideration of current legislation affecting district operations.

Owing to the extremely dry early spring season many of the districts report that water was turned into their canal systems about the first of March, a month earlier than the usual practice. Rainfall is still considerably below normal in most sections of the State and the deficient snow pack indicates that there will be a shortage of runoff for late summer irrigation where storage is not available.

Districts Securities Commission

Two meetings of the California Districts Securities Commission were held in Sacramento March 10th and 27th. Byron-Bethany Irrigation District asked and was granted approval of an assessment levy of \$48,088.41 for the year 1938. Anderson-Cottonwood Irrigation District was granted approval of plan to refund outstanding bonds of \$1,121,000 through a \$339,000 R. F. C. loan. Richvale Irrigation District's petition for approval of a contract for R. F. C. loan of \$160,000 to purchase additional interests in water rights of the Sutter Butte Canal Company, new pumping equipment, and the repair of flood damages was granted.

SUPERVISION OF DAMS

Application for construction of the Long Valley Dam of the Bureau of Water and Power of the city of Los Angeles has been approved. Construction is started on the spillways at Live Oak Dam and Pacoima Dams; on Palos Verdes Reservoir.

WATER RIGHTS

Thirteen applications to appropriate were received during February, 7 applications were denied, 12 were approved, 9 permits were revoked and the rights under 13 permits were confirmed.

Computations of 1938 diversions in the Sacramento-San Joaquin valleys have been completed.

There is nothing, incidentally, like a ducky bat to make a woman's head swim.

Highway Bids and Awards for the Month of March, 1939

Exhibit Shows Highway Progress

(Continued from page 10)

ALAMEDA COUNTY—A reinforced concrete slab and steel girder overhead crossing over the tracks of the Southern Pacific Co. at Berkeley, consisting of 15 reinforced concrete slab spans and 3 steel girder spans on reinforced concrete piers and abutments with pile foundations and about 374 feet of approach retaining walls and embankment and widening existing street. District IV, Feeder route, in Berkeley. A. Soda & Son, Oakland, \$308,136; The Utah Construction Co., San Francisco, \$321,102; Clinton Construction Co. of California, San Francisco, \$279,368; Bates & Rogers Construction Corp., Oakland, \$282,048; Earl W. Heple, San Jose, \$279,151; Union Paving Co., San Francisco, \$277,384; Lindgren & Swinerton, Inc., Oakland, \$294,603; R. G. Clifford, San Francisco, \$295,581; C. W. Caletti & Co., San Rafael, \$299,268; Chas. L. Harney, San Francisco, \$323,525; Eaton & Smith, San Francisco, \$291,789; United Concrete Pipe Corp., Los Angeles, \$286,194; MacDonald & Kahn Co., Ltd., San Francisco, \$297,321. Contract awarded to Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, \$276,900.35.

IMPERIAL COUNTY—Between 4 miles east of Calexico and 1 mile east of East Highline Canal, about 0.8 mile in length to be graded, surfaced with gravel and road-mix surface treatment applied thereto and bridges to be constructed. District XI, Route 202, Sections C.D. Valley Construction Co., San Jose, \$12,295; R. E. Hazard & Sons, San Diego, \$44,035; V. R. Dennis Construction Co., San Diego, \$53,455; J. E. Haddock, Ltd., Pasadena, \$60,533; G. W. Ellis, North Hollywood, \$62,941; Griffith Co., Los Angeles, \$66,167; A. S. Vinnell Co., Alhambra, \$70,395. Contract awarded to Parish Bros., Eldridge, \$41,636.70.

ORANGE COUNTY—In the city of Santa Ana, across Santa Ana River, a reinforced concrete girder bridge consisting of eight 53-foot spans and two 48-foot spans. District VII, Route 174, Section S.A. John Strona, Pomona, \$109,295; Vinson and Pringle, Phoenix, Arizona, \$111,840; Oscar Oberg, Los Angeles, \$114,013; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$116,569; Macco Construction Co., Clearwater, \$119,393; Byers & Dunn, Los Angeles, \$119,438; J. S. Metzger & Son, Los Angeles, \$120,690; Carlo Bongiovanni, Los Angeles, \$124,805; J. E. Haddock, Ltd., Pasadena, \$127,251; Sharp & Fellows Contracting Co., Los Angeles, \$128,579; Contracting Engineers Co., Los Angeles, \$129,489; Sordal & Bishop, Long Beach, \$129,772; United Concrete Pipe Corp., Los Angeles, \$133,287; Gibbons & Reed, Burbank, \$133,369; R. E. Campbell, Los Angeles, \$134,510; Heuser & Garnett, Glendale, \$134,869. Contract awarded to Mistry Bros. Construction Co., Los Angeles, \$106,305.00.

RIVERSIDE COUNTY—At Station 142+10, about 4 miles west of Corona, a reinforced concrete rigid frame bridge to be constructed. District VIII, Route 43, Section A. R. M. Price, Huntington Park, \$18,479; A. S. Vinnell Co., Alhambra, \$18,674; J. S. Metzger & Son, Los Angeles, \$18,892; J. E. Haddock, Ltd., Pasadena, \$19,158; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$21,374; White & Wilberg, Santa Monica, \$21,827. Contract awarded to V. R. Dennis Construction Co., San Diego, \$17,978.00.

RIVERSIDE COUNTY—3 miles east of Banning across San Geronimo Wash, three 30-foot spans to be added to an existing reinforced concrete girder bridge, new concrete foundations to be constructed for an existing timber bridge, about 0.1 mile of approaches to be graded and surfaced with Portland cement concrete pavement. District VIII, Route 26, Section C. Edward Green, Los Angeles, \$29,498; United Concrete Pipe Co., Los Angeles, \$30,537; The Contracting Engineers Co., Los Angeles, \$30,945; Franklin B. Gridley, Pasadena, \$31,810; J. E. Haddock, Ltd., Pasadena, \$33,869; Basich Brothers, Torrance, \$34,299; Claude Fisher Co., Ltd., Los Angeles, \$34,477; J. S. Metzger & Son, Los Angeles, \$31,494; Byerts & Dunn, Los Angeles, \$34,627; A. S. Vinnell Co., Alhambra, \$45,088. Contract awarded to Valley Construction Co., San Jose, \$27,380.75.

RIVERSIDE COUNTY—Between junction of Route 26 and Snow Creek, an under-grade crossing under the tracks of the Southern Pacific Co. and a bridge across Whitewater River Overflow to be constructed and about 3.2 miles to be graded and paved with plant-mix surfacing. District VIII, Route 187, Section D. The Contracting Engineers Co., Los Angeles, \$138,922; Basich Bros., Torrance, \$139,256; J. E. Haddock, Ltd., Pasadena, \$140,180; Matich Bros., Elsinore, \$142,295; United Concrete Pipe Corp., Los Angeles, \$142,297; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$146,786; Claude Fisher Co., Ltd., Los Angeles, \$147,077; Geo. Herz & Co., San Bernardino, \$149,727; Earl W. Heple, San Jose, \$150,529; Winston Bros., Los Angeles, \$151,930; Oswald Bros., Los Angeles, \$154,139; Griffith Co., Los Angeles, \$155,434; V. R. Dennis Construction Co., San Diego, \$158,485; John Strona, Pomona, \$163,443; Macco Construction Co., Clearwater, \$165,646; Sharp & Fellows Contracting Co., Los Angeles, \$169,612. Contract awarded to Dimmitt & Taylor, Los Angeles, \$135,917.90.

SAN BERNARDINO COUNTY—At Sheep Creek near Cajon, San Bernardino County, masonry cut-off wall and slope protection to be constructed. District VIII, Route 61, Section A. The Contracting Engineering Co., Los Angeles, \$4,950; Gibbons & Reed Co., Burbank, \$5,250; Edward Green, Los Angeles, \$3,587; Triangle Rock & Gravel Co., San Bernardino, \$5,495; E. S. & N. S. Johnson, Pasadena, \$3,875; Geo. Herz & Co., San Bernardino, \$3,430; J. E. Haddock, Ltd., Pasadena, \$5,208; W. R. Shriver, Los Angeles, \$5,245; R. M. Price, Huntington Park, \$4,375; A. S. Vinnell Co., Alhambra, \$3,960. Contract awarded to Matich Bros., Elsinore, \$2,921.00.

SAN BERNARDINO COUNTY—Two reinforced concrete bridges at points about 18.5 and 20 miles north of San Bernardino to be constructed. District VIII, Route 31, Section B. J. S. Metzger & Son, Los Angeles, \$62,571; Contracting Engineers Co., Los Angeles, \$72,736; R. M. Price, Huntington Park, \$73,560; J. E. Haddock, Ltd., Pasadena, \$74,152; W. E. Hall Co., Alhambra, \$74,301; Byerts & Dunn, Los Angeles, \$78,300; Gibbons & Reed, Burbank, \$82,194. Contract awarded to White & Wilberg, Santa Monica, \$60,484.00.

Moreover, an attempt has been made to illustrate the evolution of the esthetic features of highway design as well as to suggest the advantages which should, and do, accrue by virtue of intelligent and careful landscaping where climatic conditions are favorable to such treatment without excessive maintenance cost. The cooperation and interest of the California Roadside Council is gratefully acknowledged in the development of this phase of the model design.

Every part of the model is to correct scale, and the trees, shrubbery, buildings, and other appurtenances were carefully checked for historical accuracy and exactness of detail.

The basic topography of the model was first done in clay and then cast into plaster, after which the various dressings which feature the exhibit were added. The workmanship and skill throughout are of such high quality that a perfect illusion of naturalness has been created, and the model has elicited much comment and praise.

Complete plans for the highway exhibit were developed by Division of Highway's personnel, working in cooperation with the California Commission for the Golden Gate International Exposition, which supplied the funds for the construction and installation of the entire exhibition housed in the California Building.

SAN BERNARDINO COUNTY—At Turner Avenue about four miles east of Ontario, a reinforced concrete box culvert. District VIII, Route 26, Section D. Matich Bros., Elsinore, \$6,788; The Contracting Engineers Co., Los Angeles, \$5,972; G. E. Kerns, Long Beach, \$6,000; Carl Hallin, Los Angeles, \$6,157. Contract awarded to Gibbons & Reed Co., Burbank, \$5,680.25.

VENTURA COUNTY—Across Cuyama River, near Ozena, a treated timber bridge to be reconstructed. District VII, Route 138, Section E. J. S. Metzger & Son, Los Angeles, \$19,875; E. G. Perham, Los Angeles, \$21,172; Edward Green, Los Angeles, \$21,642; The Robertson Co., Los Angeles, \$21,823; R. M. Price, Huntington Park, \$23,143; C. G. Willis & Sons, Inc., & Chas. G. Willis, Los Angeles, \$23,350; S. A. Cummings, San Diego, \$23,435; Harry L. Foster, San Diego, \$23,890; The Contracting Engineers Co., Los Angeles, \$24,520; Valley Construction Co., San Jose, \$25,074; C. R. Butterfield-Kennedy Co., San Pedro, \$25,795. Contract awarded to Victor L. & Wm. B. Jacobson, Los Angeles, \$19,468.50.

Review of State Public Works Program by Director Clark

(Continued from page 14)

deal of talk on the radio and have read much that has been written about the stopping of Federal spending and stressing the balancing of the national budget. A great deal of such talk and writings have been originated and spread by well-meaning people who just naturally disagree with the theory of spending money when there is no definite provision made for its replacement. But, there is still another element represented by large numbers who are continuously preaching this same doctrine but whose motives are less sincere and certainly not constructive. I refer to those several politically ambitious individuals whose usual approach to any situation is to criticize that which is being done instead of attempting to find a practical solution for the situation that exists.

For the government to stop spending money and to immediately balance the budget makes for good political speechmaking but until something more constructive and sound is offered than has yet come to the surface in the way of a substitute for Federal spending on public works projects, I, for one, am certainly in favor of seeing national money appropriated so that further development in this country can be carried on. I dread to even think what the consequences would be in this country if the government tomorrow suddenly called a halt to the further furnishing of any Federal funds.

FEDERAL HELP NECESSARY

Let me remind you that right here in California the Metropolitan Aqueduct of Los Angeles County, the American Canal, the San Francisco-Oakland Bay Bridge—yes, Treasure Island and now the contemplated \$200,000,000 Central Valley project, with all their accruing benefits, would probably all have been impossible of attainment, at least for the present, had it not been for Federal financial assistance.

While most of these projects were aided financially by the United States

Government with the understanding that in time the total cost of same would be repaid to the Federal Government, most of them being self-liquidating, nevertheless, in most of the criticism that is heard in connection with the spending of Federal money there is no distinction made between financial aid temporarily extended by the government, which will in turn be repaid, as compared with outright grants.

As representatives of the engineering fraternity and the construction industries, it is imperative that we do everything within our power to encourage the United States Government in extending further financial aid to all public subdivisions and to assist in the building of all projects in this country which are sound and therefore worthy of this temporary national financial aid.

I do assure you that it has afforded me much pleasure to have had this opportunity to appear before you as a representative of California's new great Governor, Culbert L. Olson.

Many Motorists Have Bad Vision

A study made by the Institute of Human Relations at Yale University has revealed that from one to two per cent of the nation's automobile drivers are completely blind in one eye. A still more serious finding was that between 20 to 40 per cent of all motorists have a deficient eye which handicaps them.

Tests revealed that persons with a deficient or blind right eye have difficulty in perceiving pedestrians stepping off sidewalks or walking along the right roadway either by day or night; in viewing the road when making a right turn; in perceiving ears approaching from the right of intersections; in passing other ears; in perceiving road signs and traffic lights; in backing out from angle parking; and in keeping on the right side of the road.

Snow Pack 50% Below Normal

(Continued from page 6)

snow pack had to be packed along. In the isolated back country of the Kings River the men were out ten days, covering 130 miles on the North Fork and 14 days, skiing 140 miles, on the South Fork. Three men in the Kern River watershed were out 13 days, traveled 135 miles on the regular snow patrol of that area. Sturdy forest rangers of the Inyo Forest crossed over the high mountain passes at elevations close to 12,000 feet above sea level to make their measurements.

The measurements brought in by the snow patrol show this year's snow pack to be a decided contrast to the bountiful one of last year. Where last year's pack on the whole was 50 per cent above normal, this year's is about 50 per cent below normal. Last year where the snow tubes measured depths of from 9 to 12 feet, this year's snow is only from 3 to 4 feet deep. Last year the melting of the snow pack brought floods and high water until late into the summer; this year, barring unlikely late heavy storms, there will be no floods.

A tabulation of all the snow survey measurements, together with forecasts of flow from most of the Sierra watersheds, are contained in the Snow Survey Bulletin issued by the Division of Water Resources on April 11th. Copies of this bulletin may be had from the division upon request.

GRADE SEPARATION PROJECT IN BERKELEY

(Continued from page 22)

proper proportion of members rather than by excessive ornamentation.

Financing is from Federal grade separation funds allotted to California, except for the additional right-of-way which is being provided by the city of Berkeley.

The contractor has two hundred and seventy-five working days to complete the project and, if this schedule is maintained, University Avenue overhead will be opened to traffic early in 1940, permanently eliminating a danger spot for traffic on this busy State highway arterial in a city.

How "Speed Zoning" Safeguards Traffic

(Continued from page 19)

of hazard exist, and through analysis of these records and supplemental observation that speed zoning offers a logical means of reducing the hazards.

Similarly, engineering knowledge and careful tests must be applied to determine the type and scope of zone to be established and the physical means to be employed, such as signs, markings, etc. And, finally, the direction of enforcement must be equally intelligent and based upon recorded and observable facts.

The average driver has insufficient means of knowing safe speed at all times, just as he can not know of his own knowledge that all bridges will support the maximum load. Lacking this knowledge, one becomes unnecessarily timid and another entirely too careless. The inevitable result is confusion and frequent interruption to that free and orderly movement which we one and all wish to have.

How speed zoning may assist in reaching this goal is very clearly outlined in the following conservative statement of conclusions reached by the committee on speeds and accidents:

- (1) It aids the motorist in adjusting speed to conditions.
- (2) It makes the enforcement problem easier by furnishing the police officers with a reasonable guide of what is excessive speed.
- (3) It permits adequate control of speed at locations with unusual conditions, without unduly restricting drivers where conditions permit higher speeds.
- (4) It results in motorists' driving at a more nearly uniform speed over state highways.
- (5) When accompanied by enforcement, speed zoning is very effective in reducing the frequency and severity of accidents on dangerous sections of highway.

There would appear to be every logical reason to believe that "speed zoning," honestly predicated upon the desire to safeguard and facilitate traffic, carefully and intelligently conceived and administered, will commend itself alike to motorist, pedestrian, and the general public.

Bay Bridge Traffic Report Shows 822,914 Vehicles Crossed in March

VEHICLES totaling 822,914 crossed the San Francisco-Oakland Bay Bridge in March, it was revealed in a report submitted by Director of Public Works Frank W. Clark, secretary of the California Toll Bridge Authority, to Governor Culbert L. Olson.

The figures indicated a gain of approximately 200,000 vehicles over March of the preceding year, when the traffic total was 659,569, and a gain of 65,679 over February, 1939.

Exposition traffic accounted chiefly for the gain, Mr. Clark said, with 164,642 vehicles of last month's total going to Treasure Island. Exposition traffic from San Francisco totaled 93,646, and from the East Bay 70,996.

March's daily average of vehicles was 26,546; a slight drop from February, which had a 26,917 daily average, but a gain over the same period a year ago when the average was 21,595.

Revenues for March were \$422,904.15, a gain over the preceding 28-day month, when collections were \$390,806.86.

Total number of vehicles to cross the Bridge in the first three months of 1939 is 2,322,696, bringing the total since opening November 12, 1936, to 21,383,885.

Comparative figures follow:

	March, 1939	February, 1939	Total since opening
Passenger Autos and Auto Trailers--	738,813	673,134	19,787,267
Motorcycles and Tricars-----	3,037	2,869	95,579
Buses-----	7,384	6,596	271,307
Trucks and Trailers-----	47,138	46,832	897,520
Toll Vehicles -----	796,372	729,431	21,051,673
Passes -----	26,542	24,256	332,212
Total Vehicles -----	822,914	753,687	21,383,885
Extra Passengers-----	259,266	215,228	5,447,355
Freight Tons-----	59,981	67,245	1,100,778

FINED FOR DUMPING GARBAGE ON HIGHWAYS

The following clipping from the January 15th issue of the Redding Searchlight, tells of the arrests of violators of the law prohibiting the dumping of garbage on a State highway.

Arrests of this kind are rather rare but serve to warn people that it is illegal to use State highways as a public dumping ground.

"Two Dunsmuir men, Harry Stone and Pete Ressitti, were fined \$25 apiece by Justice of the Peace Marie C. Mahon of Castella Friday when they pleaded guilty to dumping garbage on the highway north of Castella.

"They were arrested by Traffic Officer James C. Lane. Officer Lane also arrested Charles B. Edwards for the same offense this week."

Pioneer girls got along with one spinning wheel, but modern ones must have four and a spare.

Drainage Features on Angeles Crest Highway

(Continued from page 20)

the sump behind the fill, enters the spillway 60 feet down from the entrance. Rubble masonry was used to form the connection between the pipe and the spillway.

The slide removal and storm damage repair work on the first 14 miles to Red Box Divide was accomplished by the Maintenance Department. Convict labor was used to repair the storm damage and reconstruct the highway on the following section, incorporating the newly designed drainage features.

During the early winter rains this spillway functions perfectly. However, a real test will come only after an abnormally heavy rain and when the culvert through the fill-embankment has been plugged, causing the spillway to carry all of the drainage load including the debris.

Amerigo Bozzani

(Continued from page 8)

Car Company was established and this later became Bozzani Motors, Ltd.

In 1918 the Bozzanis took over the selling of popular makes of automobiles. The first year their sales totaled only fifty cars, but by 1929 they were selling an average of 2500 automobiles a year and employing 125 persons. Bozzani Motors, Ltd., is considered one of the outstanding automobile organizations in Los Angeles.

Mr. Bozzani for years has taken an active part in the civic life of Los Angeles. He is a member of Elks Lodge No. 99, Pentalpha Lodge No. 202, F. & A. M., Jinistan Grotto No. 76 of the Masons, Al Malaikah Temple of the Shriners, the Los Angeles Consistory Scottish Rite and the Chamber of Commerce. He is a member of the Jonathan Club and is on the advisory board of the Bank of America. He is president of the Garibaldina Society, the oldest and largest Italian lodge in California.

In 1932 Mr. Bozzani was chairman of the Southern California Division of the Italian-American Democratic Committee and from 1934 to 1938 was chairman of the State of California for the Italian-American Democratic Division. In 1936 he was a delegate to the Democratic National Convention in Philadelphia and is a member of the Democratic State Central committee.

Eight-point Plan for Road Safety

Thos. H. MacDonald, Chief of the U. S. Bureau of Public Roads, has outlined an eight-point plan for increasing highway safety.

Here are the essentials set forth by Mr. MacDonald:

1. Uniform State motor vehicle traffic laws.
2. Skilled investigation of traffic accidents.
3. The establishment of a uniform system of accident reporting.
4. The establishment of an adequate highway patrol including the official inspection of vehicles.
5. The establishment of complete

In Memoriam

Elbridge M. Ray, Jr.

With the death of Elbridge W. (Al) Ray, Jr., as the result of an automobile accident on March 9, 1939, District X has lost a loyal and valuable employee, and his fellow workers in the District, as well as in Central Office, and his acquaintances in other districts, have lost a valued friend.

Mr. Ray's first services with the Division of Highways were in June of 1923 as a stakeman on survey party. He worked with the Department intermittently from then until his graduation from the University of California with a B.S. Degree in Civil Engineering in 1929. Since his graduation, Mr. Ray was steadily employed with the Department, the greater part of which time was in District X. His employment with the Division of Highways consisted of office work, and work on surveys and construction. His most recent employment was as Acting Resident Engineer on construction.

Mr. Ray was born September 30, 1905, in Lewiston, Idaho. He attended grade and high school in Oakland and then attended the University of California at Berkeley, graduating with B.S. Degree in Civil Engineering. At college, Mr. Ray was representative of the Engineer's Council for four terms, and was President of the University of California Chapter of the Junior American Society of Civil Engineers. He is survived by his widow, Vivian; daughter, Lynn Dee; his parents, Mr. and Mrs. E. W. Ray, Sr.; a brother and two sisters. To these is extended the deepest sympathy by his co-workers and the employees of the Division of Highways.

Soph—Did you ever hear the one about the racketeer sardine?

Frosh—What is a racketeer sardine?

Soph—One that always winds up in the can.

and final authority over the issuance and revocation of drivers' licenses.

6. A highway improvement program divided into two general classes of projects: (1) Those of the emergency type, and (2) Those for the long-time plan.
7. A plan of State and Federal safety organization adequate to secure on a wide scale the adoption and enforcement of the action program here proposed.
8. A national education program.

Western Highway Officials Meet

(Continued from page 15)

sociation of State Highway Officials and the Associated General Contractors be requested to give specific consideration to the problem of extensions of time for the completion of contracts and to the standardization of specifications covering this phase of the relation between contractors and the highway departments.

4. Empowering the executive committee to cooperate with the national organization with representation where necessary in connection with road legislation before congress.

The following officers were elected:

President, Robert Allen, Nevada; Vice President, B. G. Dwyre, New Mexico; Secretary-Treasurer, E. C. Knowlton, Utah; Executive Committee—R. H. Baldock, Oregon; R. E. Bobitt, Texas; Dr. L. I. Hewes, U. S. B. P. R.; Dr. D. A. McKinnon, Montana; L. V. Murrow, Washington; Charles D. Vail, Colorado; Preston Peterson, Utah.

Thursday afternoon there was a joint meeting at the civic auditorium with the Technical Division of the American Road Builders' Association.

Motor Vehicle Laws Apply to Bicyclists

Increased observance of traffic laws by bicyclists is urged by the public safety department of the Automobile Club of Southern California.

Statistics compiled by the organization show 26 persons killed on bicycles in Los Angeles County in 1938, an increase of four over 1937.

The Vehicle Code provides that every person riding a bicycle is subject to its provisions applicable to the driver of a vehicle, except those which by their very nature can have no application.

From a safety standpoint, one of the most important laws is that applying to lamps on bicycles. It states that a bicycle in use at night shall be equipped with a lamp emitting a white light visible under normal atmospheric conditions from a distance of 300 feet in front of the bicycle. It also provides that it should be equipped with a red rear reflector or light reflector visible for at least 200 feet.

STATE OF CALIFORNIA

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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FRANK W. CLARK-----Director

EDWARD J. NERON-----Deputy Director

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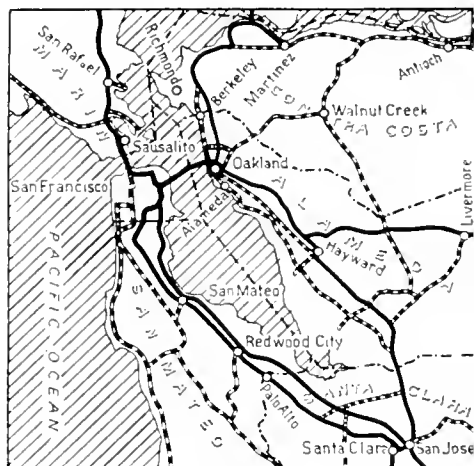
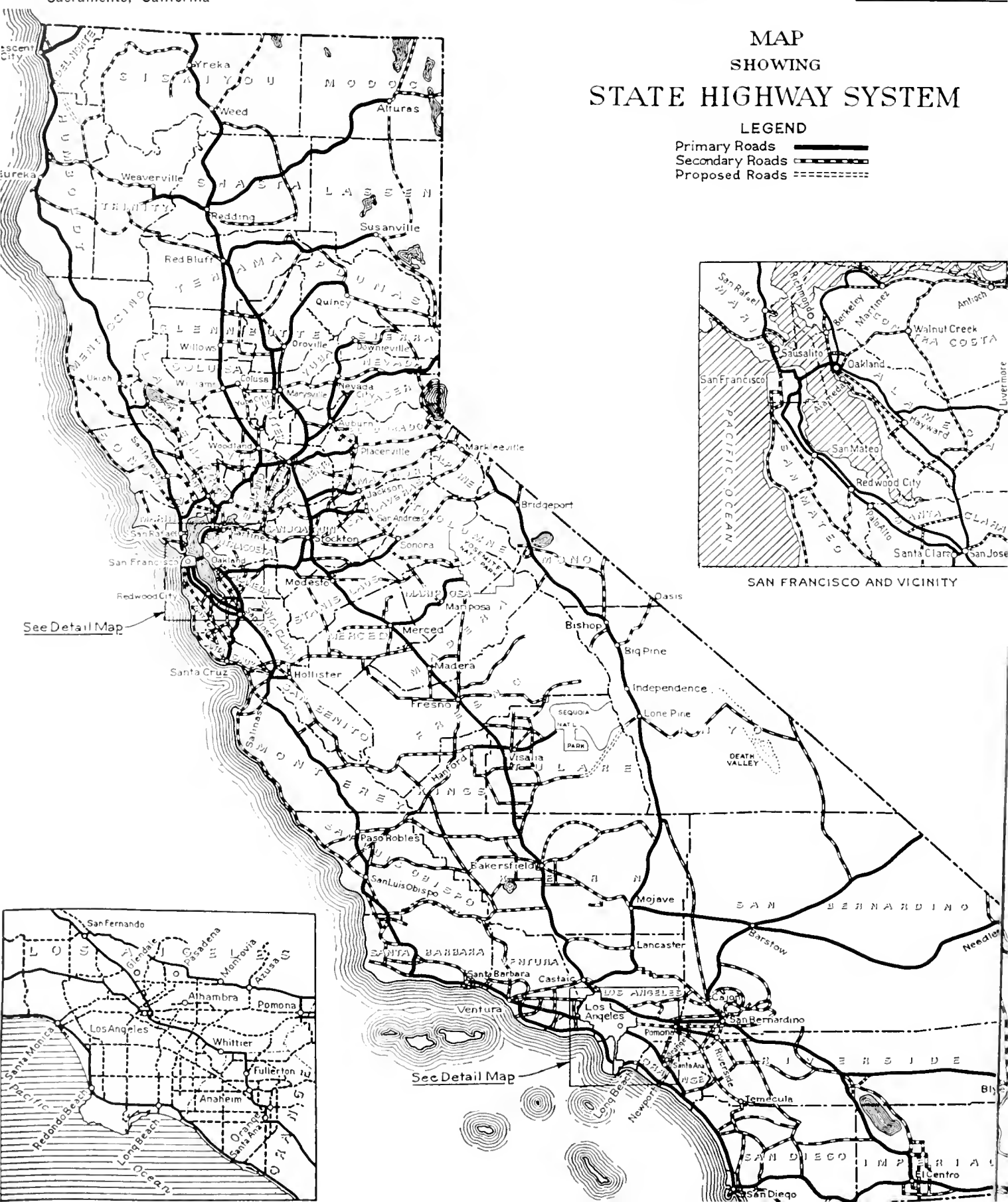
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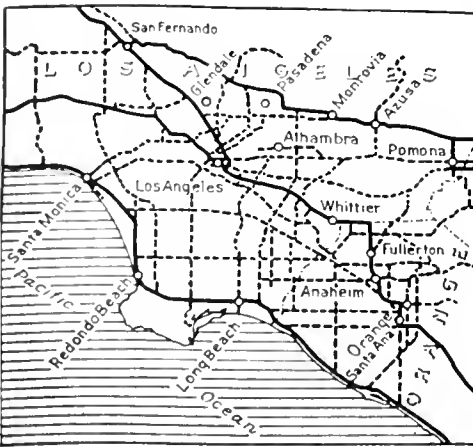
MAP SHOWING STATE HIGHWAY SYSTEM

LEGEND

Primary Roads —————
Secondary Roads - - - - -
Proposed Roads = = = = =



SAN FRANCISCO AND VICINITY



See Detail Map



California
Highway Dept.
CALIFORNIA
HIGHWAYS AND BRIDGES

Construction of a four-lane highway bridge over the San Joaquin River, California, showing the steel framework and the concrete piers.

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

Published for information of the members of the department and the citizens of California

Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request

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MAY, 1939

No. 5

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Water Authority Approves Proposed Legislation for Central Valley Project

UNDER the leadership of Governor Culbert L. Olson the Water Project Authority of the State of California is actively engaged in the consideration of policies and a program to be formulated for the operation of the Central Valley Project by the State, particularly with respect to the disposal and distribution of water and electric power to be made available therefrom. Negotiations are in progress with the Federal Government which is now constructing the main storage and conveyance units of the project under congressional authorization and appropriations, and State legislation has been prepared and introduced at the present session of the Legislature to effect the desired objectives.

The Water Project Authority is the agency created by the Central Valley Project Act of 1933 to administer the Central Valley Project on behalf of the State. Its present membership comprises Frank W. Clark, Director of Public Works, chairman; Phil S. Gibson, Director of Finance; Charles G. Johnson, State Treasurer; Harry B. Riley, State Controller and Earl Warren, Attorney General.

The Executive Officer is Edward Hyatt, State Engineer and Chief of Division of Water Resources of the Department of Public Works. A. D. Edmonston, Deputy State Engineer, is acting secretary. The technical and legal work of the Authority is conducted by the staff of the Division of Water Resources.

INITIATED BY GOVERNOR OLSON

Negotiations with the Federal Government concerning the policies and program for the operation of the Central Valley Project were initiated by Governor Olson in a letter to the Secretary of Interior on February 15, 1939, in which was submitted a proposal that the State through the Water Project Authority enter into a contract with the United States pro-

Water First Says Project Authority

The Water Project Authority adopted the following resolution defining the policy of the board:

WHEREAS, It is the intent of the Central Valley Project Act of 1933 that the Central Valley Project shall be operated primarily for the furnishing of water for the various purposes therein set forth, and secondarily for the generation of electric power; and

WHEREAS, It is necessary that electric power from the project shall carry a major portion of the cost thereof in order that the project may be a sound and economic undertaking;

NOW THEREFORE, BE IT RESOLVED, By the Water Project Authority of the State of California that the works of the Central Valley Project shall be managed and operated, the electric power from the project generated, distributed and disposed of to obtain the maximum revenue therefrom consistent with a reasonable price for electric power and the primary requirements for water, and the revenues from the project applied, to the end that the cost of water to the ultimate consumer shall be fair and reasonable,

BE IT FURTHER RESOLVED, That the Acting Secretary of the Authority is hereby directed to transmit copies of this resolution to the Governor of the State of California and to members of the Legislature.

viding for the Authority to operate and maintain the project upon completion; to repay the reimbursable costs of the project to the United States by revenues from the sale of water and electric power to public and private agencies; to construct with Federal financial assistance an auxiliary steam-electric plant at Antioch and necessary transmission and distribution facilities required for economic disposal of electric power; to direct and assist in the organization of public districts to contract with the Authority for the purchase of water and power; and to assist in the preparation and enactment of necessary enabling legislation to carry out the proposed program.

The Secretary of Interior now has the proposal under consideration. Although the policies and program are yet to be agreed upon with the Federal Government, the Secretary of Interior and the Commissioner of the U. S. Bureau of Reclamation have expressed a desire to cooperate with the State in the operation of the project and disposal of water and power therefrom.

The project will make available on the average over two million acre-feet annually of new water supplies for industrial, municipal and irrigation purposes for use in the Sacramento and San Joaquin valleys, and from one billion to one billion and one-half kilowatt hours of electric energy for use in the market of northern and central California.

The carrying charges of the project including repayment of reimbursable funds advanced by the Federal Government for construction will be met from revenues received from the sale of water and electric power. Provision for disposal and distribution of water and power is essential to the full realization of these revenues.

The project being constructed by the Federal Government makes no provision for the facilities required



FRANK W. CLARK, Director of Public Works, Chairman of Water Authority



PHIL S. GIBSON, Director of Finance, Member of Authority



CHAS. G. JOHNSON, State Treasurer, Member of Authority

for disposal and distribution of water and electric power. These facilities must be provided and be ready for operation when the main units of the project are completed. Furthermore, areas which are to obtain water and electric power from the project, if not already in appropriate districts or State agencies, must be organized into economic units, and must acquire or construct local distribution facilities and make ready for the purchase and use of water and electric power.

Since the Federal Government is not providing for disposal and distribution of water and electric power, it devolves upon the State and the local areas which are to receive the water and power to take the necessary steps to provide the required facilities and organize these agencies. It has been and is still the duty and responsibility of the Water Project Authority in accordance with the Central Valley Project Act of 1933 to see to it that the Central Valley Project is constructed and operated in accordance with its purposes and objectives so that the people served may receive maximum benefits.

Facilities for distribution of water and power and organization of proper agencies in connection therewith are essential to the project and the realization of the purposes and objectives sought. Extensive studies and investigations, engineering, legal, economic and financial, will be required to prepare plans and formulate a program with respect to disposal and distribution of water and power and these should be completed so as to be ready upon the completion of the project now anticipated in 1943.

For the purpose of putting the State in a position to effectively participate in, cooperate with and assist the Federal Government and the people which the project will serve in the realization of the objectives of the project and maximum benefits therefrom, legislation has been introduced and is now pending at the present session of the State Legislature.

PROPOSED LEGISLATION

One of the bills which is deemed of great importance is S. B. No. 1259 which amends the Central Valley Project Act of 1933 in several particulars. The need for these amendments arises from the fact that the existing act does not meet changes



EARL WARREN, Attorney General, Member of Authority



HARRY B. RILEY, Controller, Member of Authority



EDWARD HYATT, State Engineer, Executive Officer of Authority



Progress of excavation at Shasta Dam site is shown in this picture of work on the east side of river. Photo by U. S. Bureau of Reclamation

brought about since 1933 by the approval and adoption of the project as a Federal Reclamation undertaking. The objectives of the proposed amendments to the act are as follows:

1. To remove the present restriction upon the power to issue bonds, which requires that the amount of bonds authorized shall be reduced by such amount as the State or Federal government may "contribute" to the construction of the project, and thus make it possible for the Authority to sell bonds for necessary purposes; and to provide more stringent regulations for the issuance of bonds and safeguarding of funds to improve the marketability of the bonds.
2. To make certain the power of the Authority to extend aid to State agencies in making provision for the use and distribution of water and power.
3. To make certain the power of the Authority to "acquire" the Central Valley Project in whole or in part.
4. To make clear that the Authority may exercise its powers irrespective of the fact that the project

is constructed in whole or in part by the Federal Government.

Another bill of great importance to the project is S. B. No. 246 which authorizes and directs the Division of Water Resources of the State Department of Public Works "to prosecute efforts, on behalf of the Water Project Authority of the State of California, in aid of the construction of the Central Valley Project, including the preparation and formulation of surveys, plans, estimates, and other work, of whatsoever character, which may be required, including cooperation with agencies of the Federal Government," and appropriates \$250,000 for these purposes. The passage of this bill with the appropriation provided therein is considered particularly essential in order that the necessary studies and investigations may be made and plans and program prepared.

The Water Project Authority has unanimously approved these bills and is urging the adoption of both by the

State Legislature in the interest of the project and the people it will serve. It is considered that this legislation is vital to assure that the project will function successfully upon completion in accordance with its purposes and objectives.

The Authority also adopted a resolution declaring its policy with respect to the management and operation of the Central Valley Project (see first page) and another resolution approving Senate Bill No. 339 providing for the organization of mutual electric companies to operate in rural territories.

In addition to the foregoing activities, the Water Project Authority by contract with the Bureau of Reclamation is actively assisting and cooperating with the Bureau on certain important features of the project. Present activities are confined chiefly to investigations, surveys, studies and the preparation of numerous reports relating to the character, extent, lo-

cation, ownership, value and validity of water rights on the San Joaquin River between Friant Dam site and the mouth of the Merced River.

The purpose of these is to supply necessary information to the Bureau of Reclamation as prerequisite to negotiations for acquisition of water rights or the furnishing of substitute supplies in lieu thereof. Plans are also being prepared where necessary for the furnishing of such substitute water supplies. In addition, surveys are being made and maps prepared of topography, soils, ground water supplies, and ownerships covering the lands bordering the San Joaquin River between the mouth of the Merced and the delta.

THIRTY CONTRACTS UNDER WAY

Under the impetus of unusually favorable weather conditions during the past winter and spring months, construction work on the Central Valley Project has steadily forged ahead. Work is progressing under thirty major contracts awarded by the U. S. Bureau of Reclamation, which is in charge of the construction of the project as a Federal Reclamation

undertaking.

Existing contracts covering construction and the furnishing of materials and equipment involve expenditures in excess of \$47,000,000. More than thirty construction firms from sixteen states are engaged on work under these contracts. In addition, several hundred firms from thirty-three states are or have been participating in the furnishing of materials and supplies.

Federal funds made available for the project to date total \$44,600,000 including an additional appropriation of \$10,000,000 made in the Interior Department Appropriation Bill by the present Congress. Actual expenditures on the project are now running at a rate of about \$2,000,000 a month and over \$13,000,000 has been spent thus far.

CONSTRUCTION PROGRESS

About 2400 persons are now engaged in work on the project, including the personnel of the Bureau and employees of the contractors.

The scene of major construction activities is in the vicinity of Redding in Shasta County. Twelve miles

north of Redding on the upper Sacramento River, the chief storage unit of the project—Shasta Dam—is being constructed. This will be the second largest concrete dam in the world, rising 500 feet above present low water stream level. It will create a reservoir with a storage capacity of 4,500,000 acre-feet. A hydroelectric plant will be constructed at the base of the dam with an ultimate installed capacity of 375,000 kva (kilovolt-amperes) in five units, four of which will be installed initially.

The contract for the construction of Shasta Dam and power plant was awarded to Pacific Contractors, Inc., on July 2, 1938, and construction work was started by the contractor on September 8, 1938. Work under the contract is now 21 per cent complete. Excavation is proceeding on both abutments and in the central spillway section and over two-thirds of the total excavation work—2,000,000 cubic yards of earth and rock—has been completed. A temporary river diversion channel has been cut along the east bank of the river.

A by-pass tunnel through the right abutment, 1820 feet in length, to be

This view of Shasta Dam excavation work shows Sacramento River and Southern Pacific tracks which will be relocated.

Photo by U. S. Bureau of Reclamation



used as a temporary route for the Southern Pacific Railroad, is now over 90 per cent complete. It is expected that the railroad will be routed through this tunnel in July and thus permit construction on the dam to proceed without interruption to rail traffic pending the completion of a permanent railroad relocation around the reservoir.

BUILDING RAILROAD RELOCATION

A major piece of supplemental construction work is involved in the building of 30 miles of new railroad to replace 37 miles of the present line of the Southern Pacific Railroad (Shasta Route) in the Sacramento River Canyon, which will have to be abandoned because a large portion thereof will be submerged by the reservoir when the dam is completed. Construction work is now actively under way under contracts awarded covering over 20 miles of road bed grading including four of the twelve tunnels and three of the eight bridges. The grading work under way is now about 25 per cent complete.

One of the main railroad bridges crossing the Sacramento River at Redding is already nearing completion with the substructure 100 per cent complete and the superstructure about 20 per cent complete. Bids have been received for four additional miles of grading and two more bridges, and contracts for these will be awarded shortly.

Three of the railroad bridges remain to be advertised for bids. One of these will be a combination highway and railroad bridge crossing the Pit River Canyon, which, when completed, will be the highest double deck bridge ever built, rising about 470 feet above present stream level and with an overall length of 3300 feet.

In addition to the railroad relocation, fifteen miles of the State highway (U. S. 99) will also have to be relocated around the reservoir. An initial two and one-half mile section of new highway is now being constructed.

Another important activity in connection with the Shasta Dam development is the clearing of the reservoir site which is now actively under way

(Continued on page 23)

Upper picture shows workmen installing steel reinforcement bars on sides and bottom of Contra Costa Canal. Center is photograph of concrete lining machine and finishing racks used on canal and lower picture shows completed section of canal near Antioch.

Photos by U. S. Bureau of Reclamation





Preservation of roadside trees in 29-foot separation strip marks transformation of this section of U. S. 99 north of Modesto from a 2-lane into a 4-lane divided highway.

Four Lane Divided Unit Finished

By C. J. TEMBY, District Office Engineer

THE improvement of another section of California State Highway has provided increased safety for the traveling public. Four miles of the Golden State Highway, Route 4, U.S. Route 99, through Stanislaus County between Modesto and Salida have been constructed to provide a divided four-lane highway. This was accomplished by the construction of a new 23-foot portland cement concrete pavement parallel to and east of the original 20-foot width of pavement.

This section of highway traverses a portion of the Modesto Irrigation District adjacent to the city of Modesto. This area is highly productive and intensely farmed. The transportation of this farm produce, together with through-valley hauling, is reflected in the number of trucks using this highway, which totaled 1915 for the 16-hour count in July, 1938.

The combined traffic on this improved section has increased from a

total of 6042 vehicles per 16-hour count in July, 1932, to a total of 10,935 for a similar count in 1938. A 1-hour count on February 17, 1939, indicates that the volume of traffic represented by the 1938 count is being maintained.

The construction features included the widening to a minimum paved width of 50 feet with portland cement concrete base and plant-mixed surfacing, MC type, the portion of the project within the city of Modesto, and extending about 500 feet northerly to a traffic island where the divided highway separates. From this point to the pavement island at Salida, the newly constructed easterly lane of pavement is a 23-foot width of portland cement concrete. Plant-mix surfacing was used to make the connection to the existing 20-foot width of pavement at Salida, the north end of the project.

The grade of the new pavement deviates from that of the west lane in

being more uniform, although slightly rolling, with a maximum grade under 1 per cent. The greatest variation between elevations of opposite points on the east and west lanes is about 2.2 feet.

The width of the area between the pavement lanes on the divided highway averages about 29 feet; this distance permits the utilization of lines of well-grown trees which bordered the former undivided highway, thus forming a natural separation of aesthetic value.

Irrigation structures include three reinforced concrete bridges, 45, 33, and 45 feet in length. Another bridge crossing an irrigation canal in the city of Modesto was widened to 50 feet by the city, thereby eliminating the last obstruction to a minimum pavement width of 50 feet into the business district. Drainage for the dividing strips, or areas between pave-

(Continued on page 22)



At top—Looking north from Modesto on U. S. 99 showing divisional island at transition from 4-lane undivided to four-lane divided highway. Center—Guard rail construction in separation prevents cross-over traffic except at designated points. Bottom—End of transition segment showing separation strip and trees that bordered roadside of old pavement on right with newly added pavement lanes on left.

Hinged Swing Spans Feature Unique Design of Big Creek Arch Bridge

By H. E. Kuphal, Associate Bridge Engineer

THE completion of a reinforced concrete arch bridge across Big Creek, 40 miles south of Carmel, constituted the last link in a series of structures, inseparable elements of Coast Highway Route 56, between Monterey and San Simeon. Its construction introduced unusual problems in bridge design.

At the site of the crossing Big Creek meanders along the bottom of a deep "U" shaped canyon. Foundation exploration indicated that the steep, sloped canyon walls consisted of a badly fractured shale formation and that underlying the stream were beds of clay, sand and gravel of reasonable bearing value for the bridge foundations. The highway alignment at this location is immediately adjacent to the sea coast and approximately 90 feet above the bed of the stream.

In selecting a structure most suit-

able for this site foundation conditions were of course an important consideration, as was also the locale with its heavy fogs, rains and salt spray laden winds. In fact, the latter consideration ruled against a type of construction suitable for an inland site. Full consideration of these factors lead to the adoption of the reinforced concrete arch as the most suitable type for this location.

The arch structure comprises two main arch spans 177 feet 6 inches long across the canyon, and two tied half arches of 81-foot 6-inch span with 34-foot 6-inch swing spans which vault the canyon walls to the abutments at highway grade. The structure from abutment to abutment has a total overall length of 587 feet and provides a clear roadway width of 24 feet.

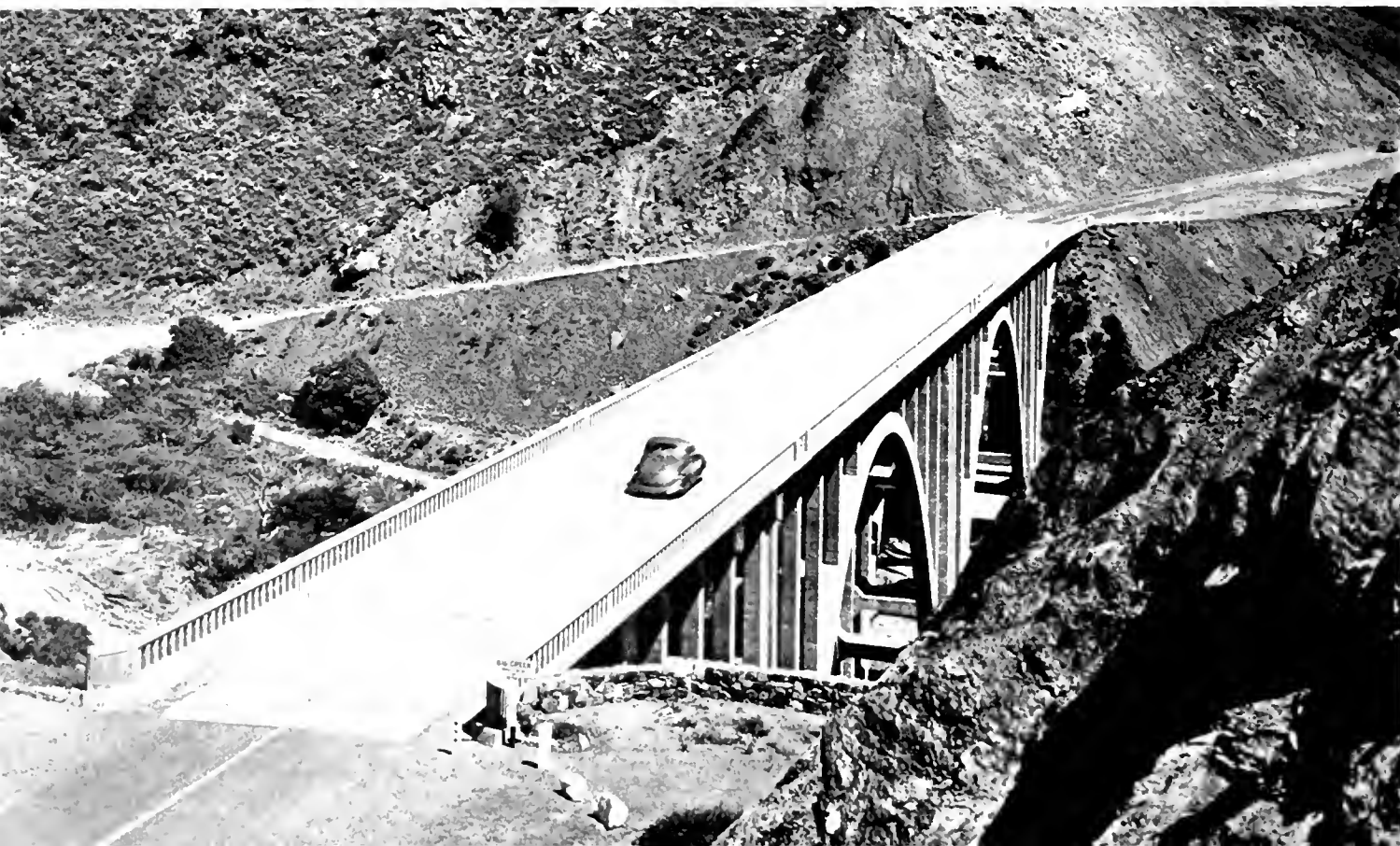
A unique feature of this structure involves the function of the swing

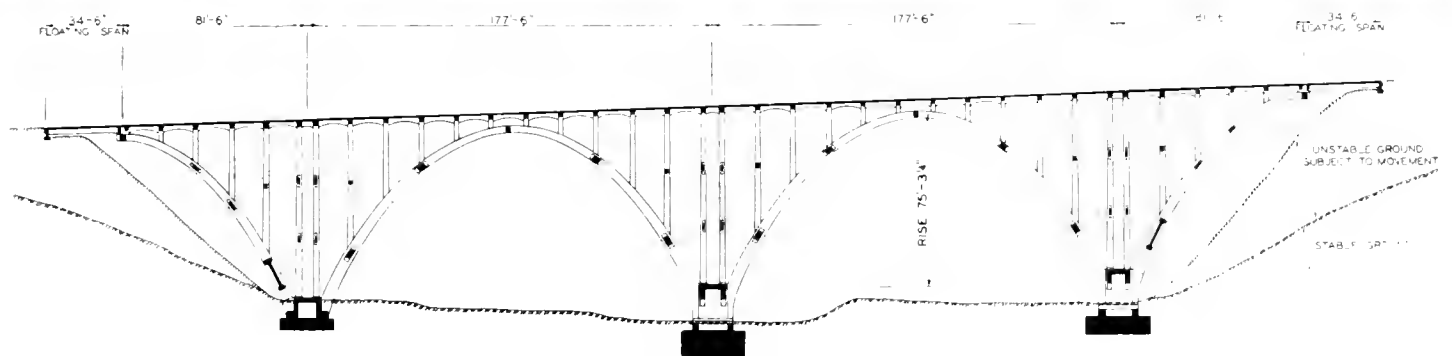
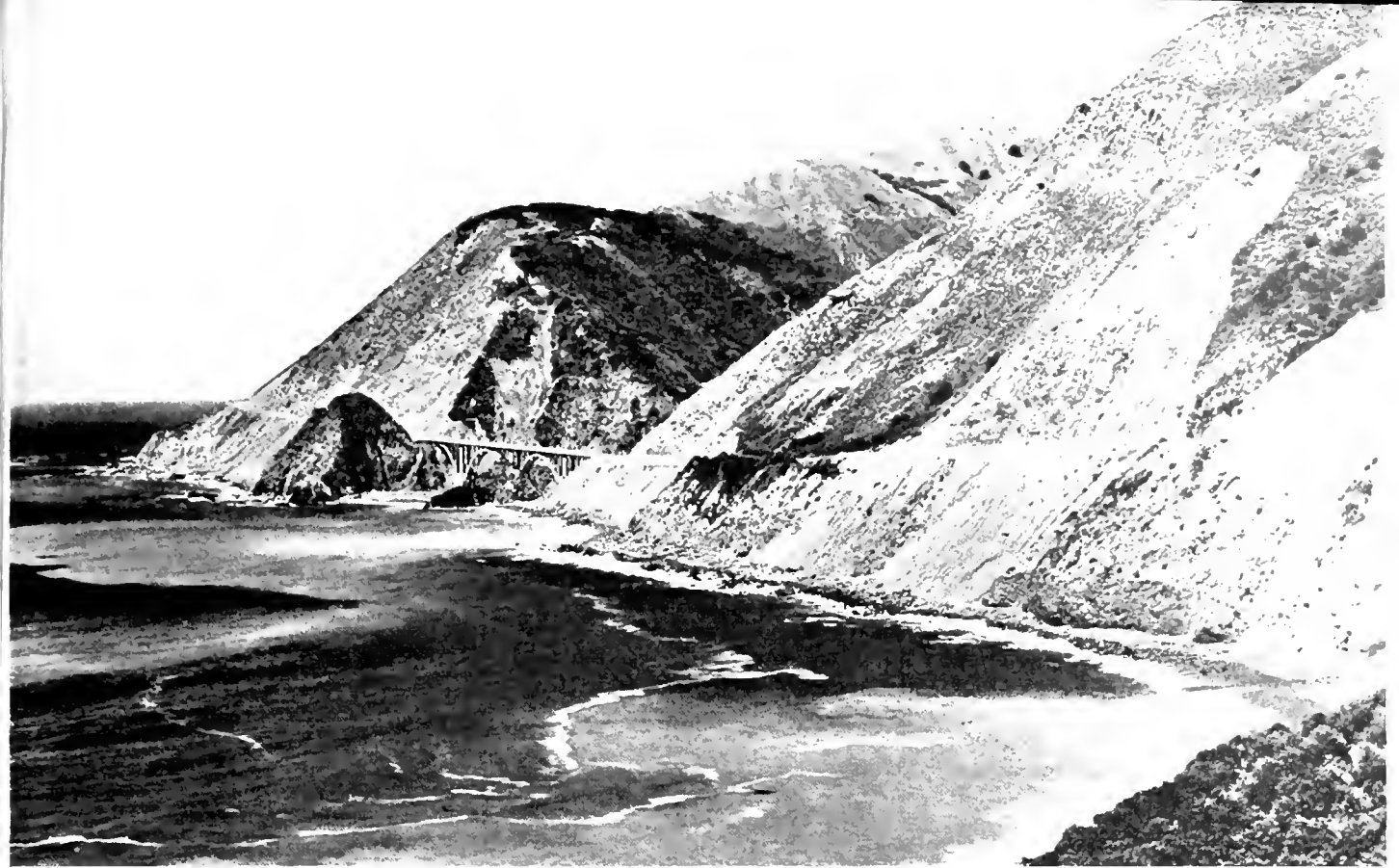
spans which are hinged to the half arches. Foundation conditions at the bridge ends indicated that the design should anticipate settlement of the end abutments. This condition, should it occur, may be readily overcome by virtue of the hinges which permit jacking the swing spans back to grade without detriment to the half arches. In effect any settlement at the abutments is localized and the correction effected with the minimum of expenditure.

The half-arch spans supporting the ends of the swing spans are hinged at the lower end and held in position by means of a steel eyebar tie extending from crown to crown of the half arches. Hinging of the half arches at their bases was indicated to eliminate stresses which would be induced by elongation and contraction of the eyebar tie from temperature change.

(Continued on page 10)

Reinforced concrete arch bridge on San Simeon-Monterey Coast Highway at Big Creek Canyon carrying highway 90 feet above bed of stream.





Big Creek Arch Bridge is a striking feature of one of the most scenic spots on the rugged coast line. Center—Sketch shows location of floating spans at both ends of the bridge. At bottom—Side view of the structure looking seaward from the floor of the wide, deep canyon.



Swing Spans Feature Arch

(Continued from page 8)

As a part of the construction sequence the eyebar ties were erected complete in place and, when under conditions of full dead load, were stressed by means of toggles located at the center pier. This operation released the falsework supporting the half arches and secured the half arches in the designed position against dead load deflection.

Each toggle was operated by a 125-ton hydraulic jack which in a measure indicates the magnitude of the dead load involved. After transfer of the dead load of the half arches to the eyebar ties, the ties were concreted for their full length in the girders of the deck floor system.

At each side of each pier an open joint provided in the deck structure exposed the ties to the action of the elements. For protection at these points the eyebars were wrapped with asphalt impregnated burlap and the whole encased in a copper sleeve.

The three 80-foot columns between the arches were designed as cantilevers fixed at the bottom and proportioned to resist equally any unbalanced live load acting on the half arches in combination with the temperature stress. The column bases were founded on spread footings designed for a maximum bearing load of 5 tons per square foot.

Design of the arch rib, that is, the selection of the curve or shape of the rib as seen in elevation is of prime importance. For certain conditions of loading and span length a rib of circular shape will prove satisfactory. However, where span length is great and loading conditions extreme the designer must resort to a more complex form of curve if the rib is to economically perform its function of delivering the applied dead and live loads to the supporting piers.

The Design Department, after study and investigation, has developed and adopted a curve for long span arch ribs which has the shape of a modified ellipse. This curve or shape which is made up of elliptical segments was used in the design of the main area ribs for the Big Creek structure.

The live loading used in the design comprised either the standard H-15

Plans Advanced for International Pacific Highway

Added impetus to the International Pacific Highway which will eventually link Fairbanks, Alaska, with Buenos Aires, Argentina, was given when highway experts of the United States, Central and South America met at the Third Pan American Highway Congress at Santiago, Chile, recently.

Financial experts at the congress estimated that \$78,308,000 would construct the highway from Mexico City to Panama. This figure was based upon latest technical information applied to surveys initiated by the Pan American Highway Confederation and made jointly by the U. S. Bureau of Public Roads and engineers of Guatemala, Honduras, Nicaragua, Costa Rica and Panama. Engineers of Mexico and El Salvador determined costs for their countries.

A plan is now under way to complete the international highway from Mexico City to the Guatemalan border, a distance of slightly more than 1000 miles. Mexican engineers estimate the cost at \$22,709,000.

The cost of completing the remaining section through Central America was estimated by the committee as follows: Guatemala, \$13,803,000; El Salvador, \$4,293,000; Honduras, \$4,375,000; Nicaragua, \$8,418,000; Costa Rica, \$12,427,000; and Panama, \$12,283,000. The international highway finance committee requested the Central American governments to examine the cost figures and submit their observations before February 1, 1940.

live loading, which consists of one 15-ton truck followed and preceded by 12.5-ton trucks at specified intervals, or one 40-ton shovel, the governing load being that which produced the maximum stress. Maximum design unit stresses for concrete and rein-

(Continued on page 28)

25,000 Miles of 4-Lane Highways Need in 25 Years

IN A PAPER presented at the 18th annual meeting of the Highway Research Board in Washington, D. C., on the sectional layout of multiple-lane highways, Wilbur H. Simonson, Senior Landscape Architect, U. S. Bureau of Public Roads, shows that 95 per cent of the State highway mileage in this country is of the primary two-lane type in which the trends in construction indicate a progressive widening of roadbed surfaces and shoulders, the flattening of crowns and of slopes of shoulders and gutters, as well as the flattening and rounding of cut and fill slopes and increasing right-of-way widths. These trends include a growing emphasis placed on the landscape development of highways.

The remaining 5 per cent of important improved highway mileage is of the multiple-lane type, which may be either undivided or divided in sectional layout. The undivided highway types of three-lane and of four or more lanes are compared with the divided highway type of four or more lanes.

"Three representative construction periods are used: 1932, 1934 and 1936. The projected trends into 1938 and the 1940's furnish a composite picture of current tendencies in the sectional lay-out of tomorrow's multiple-lane highways.

"According to the annual report of the American Association of State Highway Officials, as of July 1, 1937," says Mr. Simonson, "there were at that time 4704 miles of three-lane, 3082 miles of four-lane, and 221 miles of six-lane pavement. In other words, we had a total of about 8007 miles of multiple-lane highways in the United States in 1937.

"Of the 3303 miles of four- and six-lane widths, only 604 miles were divided so that traffic in opposing directions was separated by a raised parkway or median strip. Since the above report was prepared, some additional mileages of multiple-lane highway types have of course been constructed but exact figures are not yet available.

(Continued on page 28)

Sixty-eight Grade Separation Projects Aggregate \$11,000,000

F. W. PANHORST, Bridge Engineer

THE Federal Emergency Relief Appropriation Act of 1935 provided about seven and one-half million dollars to the State of California for elimination of hazards at railroad grade crossings.

This appropriation was followed in 1937 by an allocation of about one-half that amount under the Federal Aid Grade Crossing Appropriation for 1938-1939. Thus, in four years we have had about eleven million dollars of Federal funds for this purpose, and it appears that a brief report of the results accomplished to date would be of interest. For the background of this work an interesting article by Mr. G. T. McCoy, Assistant State Highway Engineer, appeared in the October, 1935, issue of the CALIFORNIA HIGHWAYS AND PUBLIC WORKS.

GRADE SEPARATION PROGRAMS

Briefly the history of the grade separation programs to date is as follows:

In June, 1935, the United States Congress appropriated \$200,000,000 to be expended for the stated purpose of eliminating hazards at grade crossings. The money was allotted to the various States on the basis of railroad mileage within the State, population of the State, and Federal Aid highway mileage. In addition to eliminating the hazards, one of the primary purposes of the appropriation was to furnish employment. Thirty-nine projects were programmed in California, as outlined in Mr. McCoy's article, but ultimately a total of forty-six projects which included two track removal projects and fifty actual separation structures were constructed from the 1935 appropriation.

For the fiscal years of 1938-1939 the total appropriation was \$100,000,000, giving about \$3,700,000 to California. From these funds twenty-one projects were programmed in this State and at least one additional crossing will be separated with

the savings. In the first two programs, sixty-five projects have been completed or are now under construction. Only two programmed projects remain to be advertised.

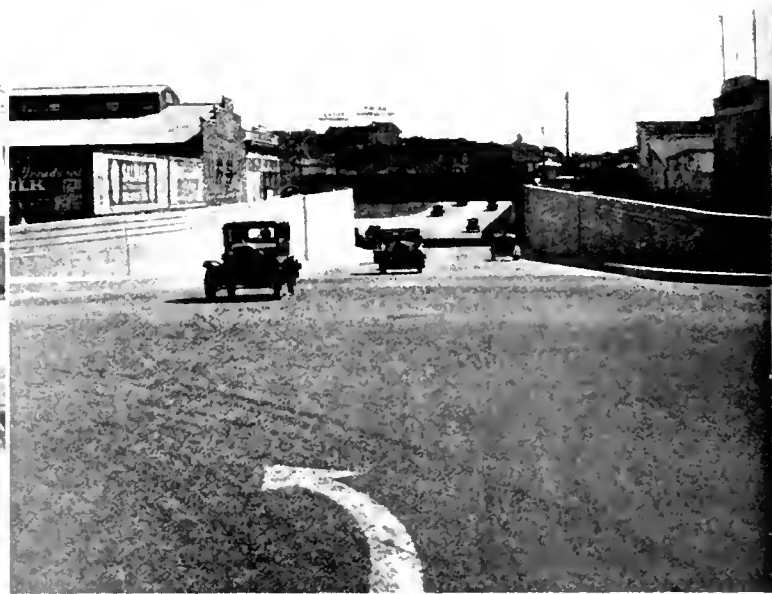
For the fiscal years 1940-41, an amount of \$50,000,000 was appropriated from which California's share will be about \$1,800,000. This last allotment has not yet been programmed, but at the present time extensive studies are being made to select the most desirable projects and to provide the greatest value for the money invested.

LOOKING BACK ON PROGRAMS

As stated, thirty-nine separations were programmed and forty-six were built under Works Progress Administration funds. Twenty-one projects were programmed and twenty-two are to be built under the second appropriation of Federal Aid grade crossing funds. The total cost of these sixty-eight projects will amount to over \$11,000,000.



Before and after views of dangerous grade crossing on Firestone Boulevard in Los Angeles. Overhead structure carries railroad tracks.



Busy railroad grade intersection with U. S. 99 that formerly caused accidents and delays at entrance to Salinas and wide underpass now that accommodates traffic of two converging arterials.

It was specified in making these appropriations that the elimination of hazards at grade crossings was desired but that the funds should be so expended as to employ as many people as possible throughout the country and to distribute the funds among the railroads. The appropriations were made at a time when unemployment was at its highest and the business of the railroads had reached a very low ebb. The problem was to select projects where the greatest amount of labor could be secured from relief rolls and crossings where the hazards were greatest to both

highway and railroad traffic.

There are 6000 grade crossings on the rural highway system in California and over 6000 more are within the corporate limits of cities. It was necessary to immediately classify these crossings in order of their importance and consider the practicability of constructing grade separations at that time.

The question of practicability involved determining if the crossing was on its final location and if other funds could be obtained to build the necessary highway leading up to it. It also was necessary to find out if the

usual high cost of right of way and property damage at important grade crossings could be financed.

No Federal funds could be expended for purchasing rights of way, paying property damage, or taking care of general right of way considerations such as approach road or street connections. A study of the twelve thousand odd grade crossings showed that the important ones where separations seemed practicable could be narrowed down to a few hundred.

It was further required by the Federal Government that 25 per cent of the allotment of funds be expended



Where U. S. 99 formerly crossed the railroad tracks at Wilson Way in Stockton, motorists now pass safely through a divided 4-lane underpass.



Railroad grade crossing on "S" curve at Livingston on U. S. 99 and underpass with 4-lane divided highway that eliminated it.

off of State highways—that is, on county feeder roads or city streets. In setting up a program covering this 25 per cent, which amounted to nearly two million dollars, it was necessary to confer with city and county officials and other civic bodies as well as the railroads, in order to arrive at the most desirable crossings to be separated and arrange for the purchase of the necessary right of way by the body having jurisdiction.

It was specifically required that the funds should be divided among the railroads on the basis of their main line mileage operated in the State and this requirement was a mat-

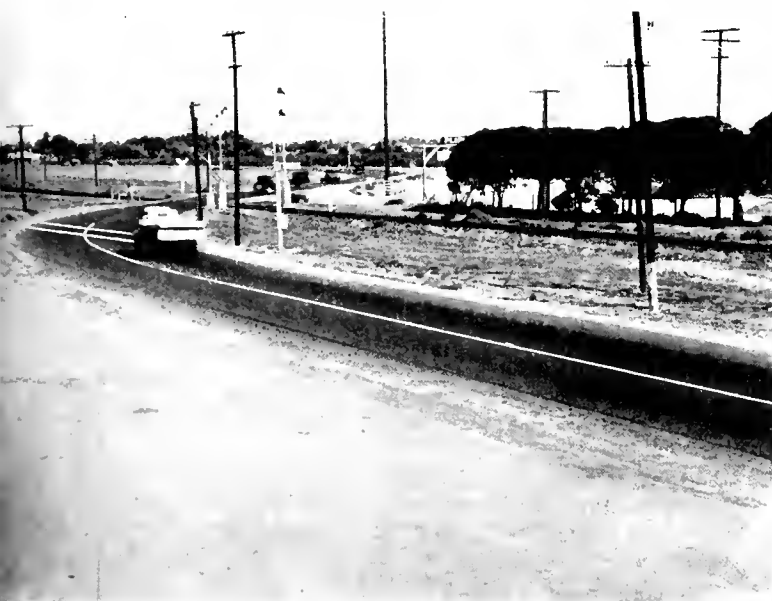
ter of no small moment. The Great Northern Railway, a Class 1 road, operates approximately one hundred miles of road through the most sparsely settled portion of the State.

Under the regulations, this mileage made it necessary to construct one grade separation project, on this line, although no crossing in that area could compare in traffic to hundreds of crossings in other locations.

The Union Pacific operates only in Southern California, and the Western Pacific only in Northern California, while the Southern Pacific and the Santa Fe operate over the greater part of the State. Grade separation

projects at important crossings are individually expensive, and the problem of distributing a relatively small number of projects over these various railroads and throughout the State so as to affect the general unemployment situation was a difficult one and caused the postponement of many important projects in thickly settled areas in order to build other projects of somewhat less importance on other railroads and in other areas throughout the State.

From the standpoint of highway construction projects, a grade separation contract is probably the most difficult of any to get under way—not



Another grade crossing on an "S" curve at Delano on U. S. 99 in Kern County and 4-lane subway that replaced it.



View of old grade crossing on curve of San Gabriel Boulevard in Los Angeles and new highway subway beneath railroad.

from a design standpoint but because of the numbers of people and agencies involved and approvals which must be secured.

In all cases on projects within city limits it is necessary to secure the cooperation of the city to establish street grades not only on the routes being separated but on connecting streets. The city sewer and water pipe lines are usually involved, and public utilities and facilities require adjustments.

Since it is also necessary in most cases to construct the separations under railroad traffic, the railroad engineers necessarily take an active interest and all structure plans and construction schedules were subject to their approval.

Within the highway organization itself it was necessary for the Bridge Department to work closely with the districts and with the Surveys and Plans Department. The Bureau of Public Roads, also, considered all problems in connection with the project such as the selection by relative importance, the design, and all stages of construction and the auditing of final bills.

In addition to normal problems there was the necessity of getting the contracts under way at the earliest possible date in order to satisfy one of the primary purposes of the allocation—relief of the unemployment situation.

The net result was that within the calendar year of 1935 California had

advertised thirty-three contracts in the amount of \$5,542,000.

UNEMPLOYMENT RELIEF

The grade separation programs in California have contributed much to unemployment relief both directly on the job and in the production of materials. In units of work the following totals are measures of results:

Excavation	1,900,000 cubic yards
Concrete	220,600 cubic yards
Steel	21,130 tons

The projects have been distributed in twenty-one counties and sixteen cities.

The average cost of grade separation projects in California has been approximately \$200,000. Contractors estimating their costs figure from 30 to 40 per cent direct labor charges. Under the Federal regulations, practically all of this employment on the first program was local. In addition to the direct labor charges on the job, comes labor involved in producing cement and concrete aggregates, mining and refining the iron ore, rolling the structural shapes and reinforcing steel, logging and milling operations in connection with the lumber, and the shipping of all these materials to the job. There is no difficulty in showing that through these operations at least 95 per cent of the grade separation funds are eventually paid to labor. Statisticians have carried the matter still further and shown that the turnover of these

dollars through the consumers and producers extends to three or four times the original investment—that is, for every man employed directly in grade separation construction three or four men are employed indirectly on resulting activities.

PROGRESS DUE TO COOPERATION

The progress which has been made in handling the \$11,000,000 of grade separation work during the two programs in the last four years, has been entirely due to the fact that the State has received the very finest of cooperation from all parties involved. The cities and counties, realizing the opportunity and the difficulties involved, quickly and efficiently disposed of problems left to them in the way of securing rights of way, establishing grades, and removing interfering facilities.

The railroads have in all cases responded in a whole-hearted fashion and have directed their entire resources to the accomplishment of the common purpose.

The public utilities, such as the telephone, gas, and electric companies, have been equally cooperative.

A tabulated list of the grade separation projects appears on the adjoining page.

The contractors are entitled to commendation in the way they took hold of the situation and marshalled their resources to accomplish the objectives of the program. In the millions of dollars worth of work, plans

(Continued on page 28)

Grade Separation Projects in the Works Progress and 1938-39 Federal Aid Grade Crossing Programs

County	Route	Project	Railroad
Monterey	2	Subway on Main Street in Salinas	S. P.
Kern	4 & 23	Subway on Golden State Highway at Famoso	S. P.
Tehama	3	Widening Subway South of Red Bluff	S. P.
Alameda	Feeder	Subway on San Leandro Street at 105th Street in Oakland	W. P. & S. P.
Sacramento	Feeder	Overhead on Jibboom Street in Sacramento, connecting with new "I" Street Bridge approach	S. P.
San Joaquin	5	Subway on Charter Way in Stockton	S. P. & W. P.
Sacramento	3	Widening Subway at 16th Street in Sacramento	S. P.
Santa Clara	Feeder	Subway on Lafayette Street connection to Bayshore Highway in Santa Clara	S. P.
Alameda	69	Overhead on East Bayshore Highway at El Cerrito Hill in Albany	S. P.
Santa Clara	Feeder	Subway on Almaden Road, San Jose	S. P.
Santa Barbara	Feeder	Rebuilding old Overhead on Los Positos Road in Santa Barbara	S. P.
Monterey	2	Subway on Coast Highway in Soledad	S. P.
San Joaquin	5	Subway on State Highway east of Tracy	S. P.
Riverside	26	Overhead on State Highway north of Indio	S. P.
Los Angeles	165	Bridge and Overhead on the Figueroa Street Extension in Los Angeles	S. P.
Los Angeles	Feeder	Overhead on Soto Street in Los Angeles	S. P.
Santa Clara	Feeder	Subway on Embarcadero Street, Palo Alto	S. P.
Alameda	5	2 Grade Separations on Revision of State Highway Alignment at Niles	W. P. & S. P.
San Francisco	Feeder	Reconstructing Subway on Army Street in San Francisco	S. P.
San Francisco	Feeder	Reconstructing and Widening Overhead on Williams Street in San Francisco	S. P.
Riverside	19	Reconstructing Overhead on new Alignment Jack Rabbit Trail west of Beaumont	S. P.
San Diego	2	Widening Overhead north of Del Mar	A. T. & S. F.
Contra Costa	Feeder	Reconstructing old Overhead near Maltby	A. T. & S. F.
Fresno	4	Overhead on Golden State Highway at Calwa, south of Fresno	A. T. & S. F.
Los Angeles	60	Overhead on Relocated State Highway Route via N and O Streets near Wilmington	A. T. & S. F.
Los Angeles	167	Subway on Atlantic Avenue near Hobart Station	A. T. & S. F.
San Bernardino	31	Subway on State Highway at Verdemon north of San Bernardino	A. T. & S. F.
Orange	171	Subway on State Highway at Northam Station, Buena Park	A. T. & S. F.
San Bernardino	58	Overhead on State Highway near Java	A. T. & S. F.
Los Angeles	174	Subway on Firestone Boulevard at Graham Station	P. E.
Los Angeles	Feeder	Raising tracks at Intersection of Mission Road and Huntington Drive in Los Angeles	P. E.
Los Angeles	Feeder	Subway under Main and Butte Street Line of Railroad on Soto Street in Los Angeles	U. P.
Alameda	105	Removal of Railroad track from 12th Street in Oakland	W. P.
Alameda	69	Washington Avenue Subway, south of San Leandro	W. P.
Alameda	105	Subway on Jackson Street in Hayward	W. P.
Alameda	Feeder	Rebuilding Subway on Mountain Boulevard in Oakland	S. N.
Alameda	Feeder	Subway on Broadway Terrace near Landvale Drive in Oakland	S. N.
Placer	37	Overpass on Realignment through Colfax	S. P.
Los Angeles	168	Subway on San Gabriel Boulevard at Riviera	A. T. & S. F.
Riverside	19	Overpass at Box Springs	A. T. & S. F.
San Bernardino	Feeder	Overpass on Palm Avenue	A. T. & S. F.
Lassen	28	Overpass at Nubieber	G. N.
San Diego	Feeder	Overpass at Solano Beach	A. T. & S. F.
San Diego	2	Overpass at San Onofre	A. T. & S. F.
San Joaquin	4	Subway on Wilson Way, Stockton	A. T. & S. F.
San Joaquin	4	Wilson Way Track Removal, Stockton	C. C. T. C.
Shasta	3	Reconstructing Subway south of Redding	S. P.
San Luis Obispo	2	Overhead on new alignment on Cuesta Grade	S. P.
Los Angeles	23	Overhead at Solamint	S. P.
Los Angeles	168	Subway under Rosemead Boulevard at Rudell Station	S. P.
Alameda	5	Replacing Overhead on old alignment at Greenville on Altamont Pass	W. P. & S. P.
Alameda	5	Replacing Overhead on old alignment at Redmond on Altamont Pass	S. P.
Contra Costa	14	Overhead at Pinole	A. T. & S. F.
Los Angeles	168	Subway at Chapman Station on Rosemead Boulevard	A. T. & S. F.
Los Angeles	168	Subway at Pico on San Gabriel Boulevard	A. T. & S. F.
Alameda	5	Underpass at Stone Cut on Altamont Pass	W. P.
Los Angeles	159	Subway at Hewitt Station on Lankershim Boulevard	S. P.
Merced	4	Subway in Livingston	S. P.
Riverside	187	Overhead west of Palm Springs Station	S. P.
Sacramento	Feeder	Subway at Air Depot, Walerga Station	S. P.
Plumas	83	Overpass and Bridge near Greenville	W. P.
Stanislaus	4	Overpass south of Turlock	S. P.
Contra Costa	106	Subway at Ohmer Station	S. N.
Alameda	Feeder	Overhead at University Avenue in Berkeley	S. P.
Santa Clara	Feeder	Subway at University Avenue in Palo Alto	S. P.
Kern	141	Overhead on Oak Street in Bakersfield	A. T. & S. F.
Los Angeles	77	Extension of existing Overhead west of Pomona	S. P. & U. P.

NOTE.—The location for an additional project completing the total of 68 has not been selected.



Relocation under construction on Ocean Shore highway north of Santa Cruz extending to Waddell Creek seen in middle ground.

New Link in Ocean Shore Road

By JNO. H. SKEGGS, District Engineer

FROM San Francisco to Santa Cruz, State Highway Route 56, Bear Sign Route 1, closely follows the ocean and is a part of the Coast Highway which will ultimately extend along the greater portion of the ocean front from Mexico to Washington.

There is at present under construction in District IV a segment of this highway in Santa Cruz County, located on a high, bare bench of Monterey shale. The portion under construction commences 11 miles north of the City of Santa Cruz and extends along a new alignment for a distance of 8.2 miles. The small unincorporated Town of Davenport, is at the southern terminus, and the northern terminus is Waddell Creek.

Northerly of Waddell Creek for a distance of over a mile Waddell Bluffs face the ocean. To construct a highway along these bluffs will challenge the ability and experience of the locating and construction forces when funds become available to reconstruct

the existing road, which leads a precarious existence menaced by the fury of the ocean on one side and slides and erosion from the bluffs on the other.

The high Monterey bench is easily eroded, and four large creeks with their head waters in the Ben Lomond mountains have trenched deeply through the shale, making it necessary to dip sharply into their valleys with the new location. The areas of the stream sheds are in general not of large extent, the longest not exceeding 10 miles in length; but the rainfall often exceeds 60 inches per year, producing heavy runoff.

The original trail was improved in 1852 by the County, and to avoid the saw tooth bluffs the road was located a considerable distance back from the coast, requiring the climbing of minor summits to regain the ocean front.

The State took over this highway for maintenance in 1933 under legislative action. When funds became available for reconstruction, surveys

showed that a large saving in mileage and in rise and fall could be had by skirting the ocean bluff.

The new highway will be 8.2 miles long, starting approximately one-half mile south of Davenport and extending to Waddell Bluffs. This is a saving over the old road of 2.1 miles in distance, with the elimination of 133 curves and 5030 degrees of curvature, and a reduction of 0.4% from the maximum grade as well as the saving of 300 feet in elevation.

There will only be minor stretches of 7% grade. The roadway surfacing will be 22 feet wide, consisting of a road mix with ROMC-3 binder for a depth compacted of 0.21 of a foot with D.G. material and 7 foot wide shoulders on each side, treated with a seal coat of screenings and 90-95 liquid asphalt.

Two of the large streams will be bridged with large reinforced concrete arch culverts, and the third stream, Scott Creek, will be taken

(Continued on page 22)



At top—Section of old narrow, winding highway on Coast north of Santa Cruz now being reconstructed. Project is 8.2 miles long, eliminating 133 curves and saving 2.1 miles in distance. Center—equipment at work widening grade. At bottom—Stretch of new roadbed along ocean bluffs showing straight, level alignment.

New State Highway Through Colfax Nearing Completion

By JOEL B. HODGES, District Office Engineer

PROGRESS reports show that the new State highway route through Colfax in Placer County will be completed late in June, making it available for the heavy summer traffic.

This project is another important improvement on U. S. 40 between Sacramento and Truckee. Its use will enable through traffic to avoid the existing main line crossing of the Southern Pacific Railroad and the abrupt turns and interference with local traffic in Colfax.

The new route, $1\frac{1}{2}$ miles in length, leaves the existing State highway ap-

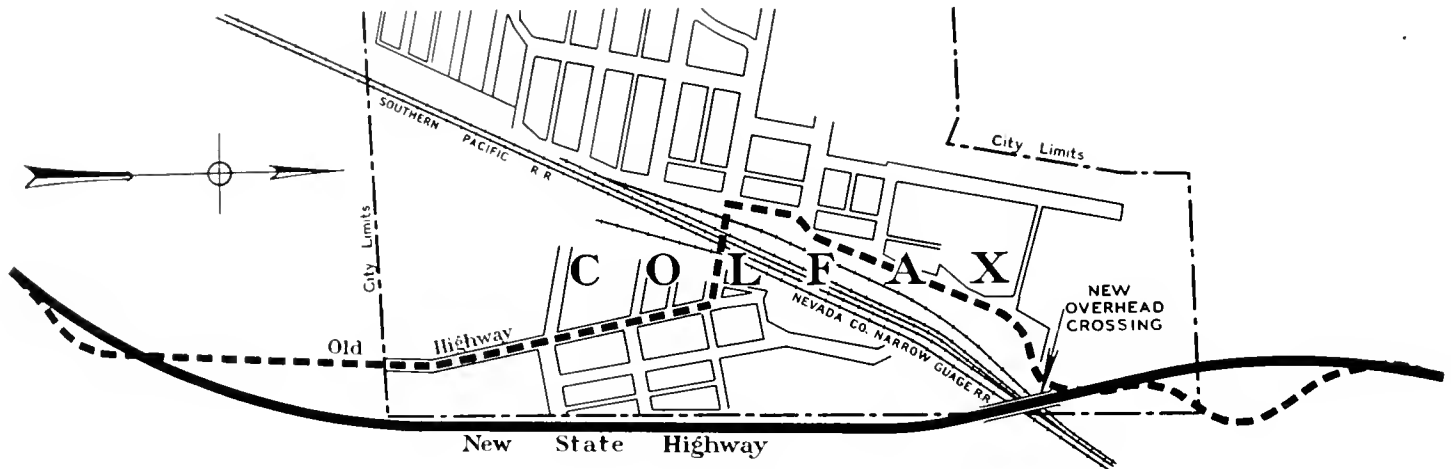
Funds have been included in the recommended budget for the next biennial budget to provide for an improved connection to the State highway approximately one-half mile north of the overhead. It is expected that this extension will be completed early this fall.

The construction on the present project was divided into two contracts, one for the grade separation structure and one for the road construction.

The construction periods on both contracts were so coordinated that the road construction will be completed

forced concrete abutment span. The total length of the structure will be 504.30 feet.

The north 88.59-foot span crosses over two Southern Pacific Railroad main line tracks and one switch track. The steel girders are supported by four concrete piers, each pier consisting of two slender concrete column bents with a deep diaphragm across the top. The piers and abutments are placed with a 41-degree skew to the center line of the roadway. The maximum height of the roadway above the ground is approximately 67 feet.



Sketch showing relocation of State Highway 37 (U. S. 40), at Colfax in Placer County.

proximately one-half mile south of Colfax and follows along the east side of Colfax to a connection with the existing State highway north of Colfax, effecting a saving in distance of 0.2 mile.

The alignment and grades on the project conform to present-day high standards, the minimum curve radius being 3000 feet.

TWO CONTRACTS

Insufficient funds made it necessary to terminate the present construction with a temporary connection to the existing State highway immediately north of the overhead structure.

soon after the completion of the overhead.

OVERHEAD GRADE CROSSING

Bids on the overhead were opened on July 27, 1938, and a \$117,882 contract awarded to the Campbell Construction Company at Sacramento for the construction of the crossing which is over the Southern Pacific Railroad tracks and the Nevada County Narrow Gauge Railway tracks.

The new bridge will consist of two steel girders and a reinforced concrete deck, consisting of one 101.99-foot span, one 94-foot span, one 93.97-foot span, one 90-foot span, one 88.59-foot span and one 35.75-foot reim-

The new bridge is designed for a 26-foot roadway with a 2-foot 7-inch sidewalk along each side. A steel hand railing made up of square tubular sections will extend along the entire length on each side.

The road contract, on which work has recently been resumed after a winter shut-down, consists in general of constructing a graded roadbed 36 feet wide, placing selected material over the full width of the roadbed and surfacing with plant-mixed surfacing 22 feet wide by 0.25 of a foot thick on a crusher run base 23 feet wide by 0.4 of a foot thick. The min-

(Continued on page 27)



At top—grade crossing of tracks of Southern Pacific main line in city of Colfax, Placer County, where U. S. 40 makes numerous abrupt turns for through traffic. A relocation follows the east side of the city eliminating turns and carrying the highway over the railroad tracks on a steel and reinforced concrete bridge structure 504.30 feet long, shown in bottom picture under construction.

Aerial Motion Pictures as Aids to Traffic Engineers

By MILTON HARRIS, Associate Highway Engineer

THE collection and analysis of traffic patterns is one of the essential elements of highway engineering. Traffic patterns might be defined as the recurrence of certain driving habits indulged in by motorists. These behaviors are affected to more or less degree by various extrinsic conditions such as the highway structure, roadside development and other streams of traffic.

Ascertaining the relationship of these physical conditions to traffic patterns is a form of engineering analysis. Ascertaining the effect that changes in the physical conditions have on traffic flow is a form of engineering research, and applying a physical change to obtain a known traffic pattern is a form of engineering design. Summed up, they constitute the elements of traffic engineering.

STUDY OF DRIVING HABITS

The collection of data from which to derive traffic patterns is no different than sending out a survey crew for the purpose of collecting geographical facts upon which a location design may be founded. The traffic survey has for its purpose the collection of factual data from which traffic patterns may be derived and analyzed.

In these film pictures, engineers can study the movement of several cars and a truck past a traffic island at intersection of two arterials. Preparation and operation of the captive balloon with movie camera attached is shown in other pictures.

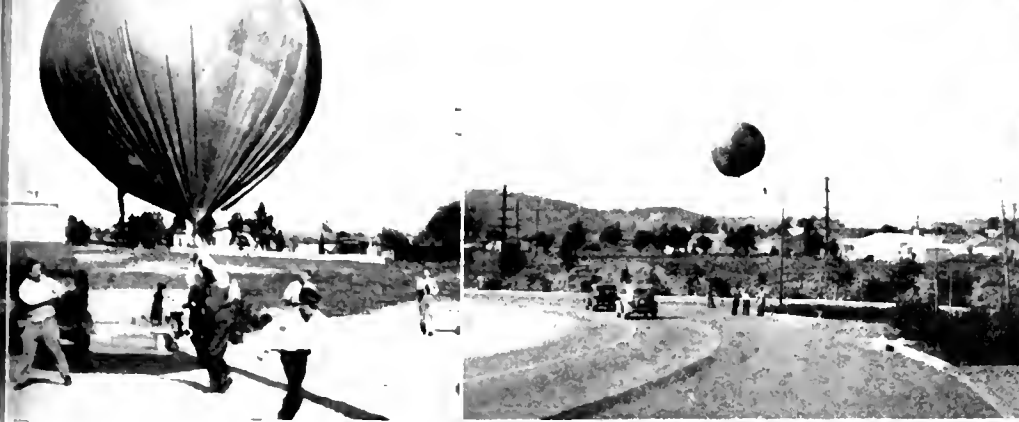
The isolation of malign driving habits is one of the principal objects of traffic engineering analysis, inasmuch as these types of behavior lead to accidents or to friction within the traffic stream. The isolation of these habits from those that are normal is often very difficult, but they are present in any traffic stream and a close study of the flow should make them apparent.

The visual study of traffic flow on the ground presents many difficulties. The continuous movement is distracting, combining as it does, all the multiplicity of movements inherent in any stream. The human eye can not pick out and retain the course of a single car without gathering other impressions that detract from the value of the study. It is necessary to stop the motion at any point and analyze its relation to surrounding elements.

Photography seems the ideal medium to accomplish this feat. A bird's-eye-view of traffic lends itself to study from an angle that encompasses all the elements having an influence on traffic. Milwaukee, Wisconsin, experimented with a still camera attached to a captive balloon for the purpose of making site plans of intersections. Their results seemed to be eminently satisfactory, although they were only able to take one picture each fifteen minutes. To study traffic movement a continuous set of pictures is necessary and with this thought in mind, a motion picture camera seemed to be the logical answer.

In its work of simplifying traffic





studies the Safety Department of the Division of Highways has recently completed an experimental test in which a 16-mm. motion picture camera was sent aloft attached to a captive balloon and actuated by ground control. The cooperation of the Goodyear Tire and Rubber Company and Bell and Howell Company, camera manufacturers, was obtained in devising and furnishing the necessary equipment.

A small motion picture camera equipped with a wide angle lens was mounted in an aluminum frame to which was attached a solenoid and plunger connected to the shutter release and actuated by a power supply on the ground. An 11-foot spherical balloon was filled with helium gas and the camera so mounted thereon that it swung free with its lens normal to the ground.

Two bronze guy wires, in addition to the main steel cable, which controlled the elevation of the balloon, were used not only for holding the bag in position over the road but also as transmission lines for the current that actuated the shutter release.

The balloon with its complement of camera and guys was sent aloft over a typical intersection in the vicinity of Los Angeles. It was anchored in such a manner that the lens framed a good portion of the intersection. The ground crew was disposed out of sight of the motorists. The traffic observer was in such a position that he could operate the camera by remote control whenever he desired to take a length of film depicting a movement he wished to record.

Close watch was maintained to note any change in normal driving habit due to the balloon floating above the pavement, but its height was such that it did not seem to be a source of interest to drivers and no perceptible change in the manner of driving was apparent.

The results appear to fully justify the experiment. It was feared that the swinging of the camera would blur the pictures, but they seem to be

clear enough for study and the intersection was well framed. The uses to which such paraphernalia might be put are numerous in traffic investigation, particularly in rural areas.

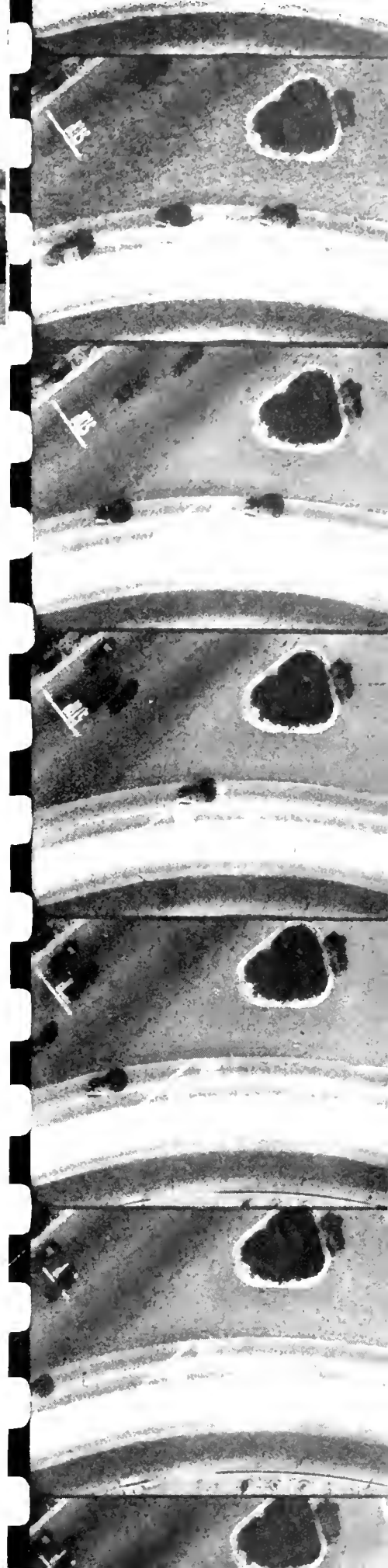
Density and speed checks are easily obtained if the camera speed is known and a ground control provided. For vehicle paths aerial photography is without doubt the most practical method so far devised. Three or four frames should be sufficient to plot the path of most any machine within the area covered by the lens. Types of vehicles are easily ascertained and traffic violations may be detected, especially when the film is viewed through a hand-operated "editor" where it can be stopped and studied at any desired point.

MOTORISTS NOT AFFECTED

Pedestrian interference is a large field for research and by means of aerial views may be readily broken down into behaviors for analysis. Site plans and location of objects that offer impediment to lines of sight are easily obtained from the air.

Many of these phases of investigation would be made concurrently from a study of the film. By varying the speed of the film, very efficient use can be made of the footage taken aloft. One hundred feet of 16 mm. film contains 4,000 individual frames and at a normal speed of 16 frames per second will run for 4 minutes, 10 seconds. By cutting the speed to 8 frames per second, twice the length of time will be consumed. By a simple mechanical arrangement individual frames may be "shot" at the operator's will, thus making a variety of frame speeds available to suit the needs of the survey.

Modernization of survey equipment and methods should engage the attention of all engineers. It seems quite fitting, therefore, that the most modern methods are so adaptable and should be made available for that most modern profession—the profession of traffic engineering.



Four Lane Divided Unit Finished

(Continued from page 6)

ment lanes. was found necessary and accomplished by installing 12-inch corrugated metal pipe culverts beneath cross-overs and for cross-drains as required.

Cross-overs were placed at county road intersections and at intervening locations for local traffic. The latter were placed a maximum distance apart of approximately 3300 feet. The cross-overs were limited to the minimum number considered necessary for the convenience of local residents on account of the hazard and interference with general traffic.

The portland cement concrete pavement designated Class "B" contained five sacks of cement per cubic yard. The maximum size aggregate used in the mix was 3½ inches. Aggregate was hauled from the contractor's batching plant in trucks, each containing two 1-cubic yard batches. Cement was added on the grade, being dumped from sacks into the hopper of a concrete mixer.

TRAFFIC ISLANDS INCLUDED

The concrete was placed on the subgrade between wood side forms, tamped with a mechanical strike-off screed and tamper, and finished with a mechanical finishing machine. After the concrete took an initial set, a 10-foot straightedge was used, and all high spots were removed with an 18-foot bump cutting float.

An average compression strength of 4088 pounds per square inch was obtained from 28-day tests of this concrete. Transverse and longitudinal pavement joints are being sealed with latex joint filler as developed by the Materials and Research Department of the Division of Highways.

Safeguards to traffic are noted in the construction of traffic islands at each end of the divided highway. These islands are each provided with amber electric light flashers set in portland cement concrete curbs in which a special recessed design reflects a white paint.

Two grade crossings with railroad spur tracks are each provided with two overhead illuminated RXR signs

An Appreciation

Carnegie Institution of Washington
MOUNT WILSON OBSERVATORY
Pasadena, California

Mr. S. V. Cortelyou,
District Engineer
Los Angeles, California

Dear Mr. Cortelyou:

About a dozen of us, employed by the Mount Wilson Observatory of the Carnegie Institution of Washington, are year-round residents on Mount Wilson, and the condition of the Angeles Crest Highway is, of course, a matter of great interest and importance to us.

All of us particularly appreciate the highly satisfactory service which has been rendered this year in connection with this road. Emergencies resulting from difficult weather conditions have been handled promptly and efficiently, and as a result the problem of safe transportation to and from Mount Wilson has never proved serious.

Will you be good enough to express our cordial appreciation to whatever department is most directly responsible for this very satisfactory service.

Very truly yours,

EARL F. KARR (signed)

5 by 8-foot in size, two reflectorized advanced warning signs, two wooden crossbuck signs and standard pavement marking. In addition to the usual pavement traffic striping and warning and directional signs, there were installed 4708 lineal feet of guard railing and 136 culvert markers and guide posts.

The major contract items included the following quantities.

Water.....	8,078 M gals.
Roadway excavation	9,932 cu. yds.
Structure excavation	1,449 cu. yds.
Imported borrow.....	39,305 cu. yds.
Untreated crushed gravel or stone surfacing	8,436 tons
Mineral aggregate (PMS).....	2,219 tons
Structure concrete.....	291 cu. yds.
Pavement concrete.....	14,171 cu. yds.
Reinforcing steel	112,428 lbs.

Fredericksen & Westbrook was the contractor for this project. The Resident Engineer was R. H. Lapp. A total of 54,421½ man hours for all classes of labor used on the contract is indicated from the contractor's pay rolls.

The approximate total cost of the construction is \$208,000. The project was financed from State highway construction and Federal Aid funds and the one-fourth cent gas tax allotment to the city of Modesto.

New Link in Ocean Shore Road

(Continued from page 16)

care of by a reinforced concrete bridge, 160 feet in length, resting on concrete piles. The fourth stream, which is Waddell Creek, will not be bridged until the section through the Waddell Bluff has been realigned.

Considerable truck farming and dairying is in progress along this entire route, this coast route being naturally the only road available for people living on the western slopes of the Santa Cruz and the Ben Lomond country. There is a comparatively small amount of dense fog.

The ultimate distance from Santa Cruz to San Francisco, via the Coast Road, will be approximately the same as other inland routes, with the added features of no cross traffic and the absence of long sustained grades. This improvement, along with others, eventually should be a great boon to truck transportation, also recreational purposes, and even for through traffic service a new, fast and scenic highway is in the making.

The progress to date has been very good, due to the unusual amount of rainfall during the past winter. It has been possible to work a continuous two 8-hour shifts, without any interruption with the equipment even during the rain, due to the Monterey shale and sand formation.

This is the third section of the Ocean Shore Highway to be improved since 1936; the first section being a 3-mile section just out of the City of San Francisco, and the second section being the San Pedro relocation, between Farallone City and Rockaway Beach, a distance of 6 miles.

It is expected that another difficult section will be constructed during the next biennium in the neighborhood of Tunitas Creek.

The project is being built on a cooperative basis from Federal, State, and Joint Highway District No. 9 funds. Joint Highway District No. 9 comprises the counties of San Francisco, San Mateo and Santa Cruz. The directors of the District are members of the Boards of Supervisors of the respective counties; John M. Ratto

(Continued on page 25)

Legislation for Central Valley Project Proposed

(Continued from page 20)

with two companies of Civilian Conservation Corps youths engaged thereon. An area of 23,500 acres will be cleared of brush and timber. Usable timber is being salvaged, but most of the forest cover is in brush and small trees which are being cut, piled and burned.

Several important contracts for material and equipment have also been awarded. These include a contract with the General Electric Company for the furnishing of four electric generators rated at 75,000 kva each and a contract with Allis Chalmers Company for the furnishing of four hydroelectric turbines each with a rated capacity of 103,000 horsepower. Bids will be opened on June 1st in Sacramento for the furnishing of 2,800,000 tons of sand and 7,600,000 tons of gravel to be used as aggregates for the concrete to be placed in the dam and power plant. In addition bids have recently been opened in Washington, D. C., for the furnishing of cement for Shasta Dam in various amounts up to 5,800,000 barrels.

It is now expected that the first concrete will be poured in Shasta Dam in March, 1940. In the meantime, the excavation work on the dam will be largely completed and materials will be provided and equipment installed for the manufacture and placing of concrete of which 5,600,000 cubic yards will be required for the dam and power plant.

BUILDING CONTRA COSTA CANAL

The second scene of construction activity is in Contra Costa County, where work is under way on the Contra Costa Canal. Construction work—the first undertaken on the project—was started on this canal in October, 1937. The first four miles, which is an unlined earth canal, has already been completed and an additional sixteen miles is now being built under two contracts which, when completed, will bring the finished section of this canal to the vicinity of Pittsburg. Four pumping plants are also

(Continued on page 26)



Photo by U. S. Bureau of Reclamation
Through this by-pass tunnel, main line railroad traffic now crossing site of Shasta Dam will be routed early this Summer.



THE Division of Water Resources, representing the Water Project Authority of the State of California, has continued the preparation of data and reports provided for in an agreement between the United States and the Authority. In connection with this work, field surveys are being made for the preparation of topographic maps of the lands along the San Joaquin River between Friant and the Gravelly Ford Canal, and between the mouth of the Merced River and the San Joaquin Delta. Also, in connection with the studies of the water rights of the lands bordering the San Joaquin River, soil survey maps are being prepared of the areas along the river between the same points.

Work also continued on the preparation of data for reports on the acquisition of, and a plan of exchange for, waters of the San Joaquin River claimed by properties east of the river in Merced County and south of the river in Fresno County.

DISTRICTS SECURITIES COMMISSION

Considerable work was done in the commission office upon the formulation of a re-financing plan for submission to the bondholders of Montague Water Conservation District. The board of directors of the district at the request of the commission submitted data upon the estimated ability of the district to pay and it is hoped that a proposal may soon be placed before the bondholders for their consideration.

Hearings in the U. S. District Courts upon the petitions of several irrigation districts for confirmation of their refunding plans have recently been held or are scheduled for the near future. Some plans which have been confirmed by the courts have been taken to the Circuit Court of Appeals.

SPECIAL INVESTIGATIONS

Investigations and the preparation of reports on work for which applications have been made for allotments from the State Emergency Fund for the restoration of prop-

erty, levees, flood control works, county roads and bridges damaged by the floods of the 1937-38 winter season, were continued and seven reports and recommendations were submitted to the Director of Finance pursuant to his instructions. Nine allocations were made by the Director of Finance for flood damage repair work during the month. The total amount of outstanding allocations at the end of the month was \$4,501,300. The Division of Water Resources has performed or is performing considerable of the work for which these allocations were made and the remainder is being done by the applicants under 132 contracts entered into with the Department of Public Works. These contracts cover work which will cost \$3,373,700, much of which has already been completed.

SUPERVISION OF DAMS

Application was filed on March 23, 1939, for approval of the Last Chance Weir in Kings County, owned by the Last Chance Water Ditch Company, Hanford, California.

Application was filed on April 3, 1939, for approval of plans and specifications for the construction of the Kimball Creek Dam in Napa County, owned by the City of Calistoga, Calistoga, California.

Bids have been called for work on the Long Valley Dam in Mono County and construction will start in the very near future. Construction work is progressing on Palos Verdes Reservoir in Los Angeles County.

FLOOD CONTROL AND RECLAMATION

Routine maintenance work has been carried on during this period. There has been a total lack of flood water during the winter and the usual winter and spring activities were not necessary. Irrigation has commenced in the Sutter By-pass and adjoining area. An unusually large area of rice will be planted and preparation is being made for irrigation flooding of the bean lands in the by-pass preparatory to planting.

With the aid of WPA labor, the channels of the Butte Slough By-pass and Knights Landing Ridge Drainage Cut are being cleared. An average of 65 men has been engaged in this work. The truck and storage shed at the Sutter yard is nearing completion, all labor being furnished by WPA.

Emergency Levee Repair

All construction work under this project has been completed, the last unit being the dike near the head of Edgar Slough, in which

two irrigation conduits were constructed with funds provided by local interests. The completion report on this project is now being prepared.

Relief Labor Work

Under WPA Project No. 10612, sponsored by this department, approximately 953 men are now assigned. A total of 66,702 man-hours of labor have been applied from March 26th to April 22d, inclusive, an average of 3,739 man-hours per working day. This is equivalent to a continuous working force of 467 men working eight hours per day.

Emergency Flood Damage Repair

The repair of the damaged units of the Sacramento River Flood Control Project has been carried on by the division by force account during this period. Of the \$150,000 available, approximately \$114,000 has been expended to date.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

Field work has commenced and at present consists of visiting all points of diversion and return flow to insure that records of pumping operations and return flow stations will be kept during the coming season. Discharge measurements are being made at all of the larger plants which are at present in operation. On account of the abnormally dry season, the majority of diversion plants are in full operation. The rice planting program is well under way and in many sections completed. In view of the impending water shortage, it is apparent that the irrigators are all endeavoring to soak up the ground while water is yet available.

The annual mimeographed report of this office is virtually completed and it should be available for distribution some time in May. The stream flow into the delta is rapidly decreasing, the flow of the Sacramento River at Verona having fallen from 11,000 cubic feet per second on April 14th to 8000 cubic feet per second on April 21st. The flow of the San Joaquin River at Vernalis is likewise rapidly decreasing and on April 22d was 2400 cubic feet per second.

You have heard, of course, about the English bulldog that went for a tramp every day.

Dora's N. Y. cousin is worried about the campaign to do away with noises. She's been studying for three years to be one and was to get her diploma at the hospital next June.

Highway Bids and Awards for the Month of April, 1939

ALAMEDA COUNTY—A reinforced concrete girder bridge, Arroyo de la Laguna, at Sunol, consisting of six spans with total length of 310 feet and about 0.25 mile of roadway to be graded and surfaced with plant-mixed surfacing and penetration oil treatment applied to shoulders. District IV, Route 107, Section A. Eaton & Smith, San Francisco, \$46,839; Earl W. Heple, San Jose, \$47,680; M. J. Ruddy, Modesto, \$48,451; E. T. Lesure, Oakland, \$48,526; C. W. Caletti & Co., San Rafael, \$49,976; MacDonald & Kahn Co., Ltd., San Francisco, \$51,928; Heafey-Moore Co. Fredrickson & Watson Const. Co., Oakland, \$52,322; Lindgren & Swinerton, Inc., Oakland, \$52,871; A. Soda & Son, Oakland, \$55,000; R. G. Clifford, San Francisco, \$55,990. Contract awarded to Caputo & Keeble, San Jose, \$44,760.

LOS ANGELES COUNTY—On Arroyo Seco Parkway across Arroyo Seco Channel near Hough Street, a reinforced concrete box girder bridge having a total length of approximately 422 feet composed of a main center span and four approach spans. District VII, Route 205, Section S. Pas. John Strona, Pomona, \$138,615; J. S. Metzger & Son, Los Angeles, \$143,875; J. E. Haddock, Ltd., Pasadena, \$153,396; Bates and Rogers Contracting Corporation, Oakland, \$154,481; Carlo Bongiovanni, Los Angeles, \$157,899; Andy Sordall & R. R. Bishop, Long Beach, \$159,924; Chas. J. Dorfman, Los Angeles, \$162,780; Byerts & Dunn, Los Angeles, \$163,295; United Concrete Pipe Corp., Los Angeles, \$166,606; Heuser & Garnett, Glendale, \$169,322; Mitty Bros. Construction Co., Los Angeles, \$172,821; C. O. Sparks and Mundo Engineering Co., Los Angeles, \$176,222; A. T. Cassell-Fred E. Potts Co., Los Angeles, \$205,157; Gibbons & Reed, Burbank, \$218,711. Contract awarded to Contracting Engineers Co., Los Angeles, \$134,727.

LOS ANGELES COUNTY—West of Pomona, two reinforced concrete girder overhead crossings to be constructed and approaches, about 0.7 mile in length, to be graded and paved with Portland cement concrete and plant-mixed surfacing. District VII, Route 77, Section B. C. O. Sparks & Mundo Engineering Co., Los Angeles, \$181,094; United Concrete Pipe Corp., Los Angeles, \$182,325; J. E. Haddock, Ltd., Pasadena, \$182,401; Claude Fisher Co., Ltd., Los Angeles, \$182,562; The Contracting Engineers Co. & S. Edmondson & Sons, Los Angeles, \$184,199; Daley Corp., San Diego, \$188,594; J. S. Metzger & Son, Los Angeles, \$188,887; Gibbons & Reed Co., Burbank, \$191,676; Griffith Co., Los Angeles, \$192,834; Basich Bros., Torrance, \$204,695; Chas. J. Dorfman, Los Angeles, \$210,157; Matich Bros., Elsinore, \$218,311. Contract awarded to John Strona, Pomona, \$171,466.75.

MARIPOSA COUNTY—Between Briceburg and El Portal, about 12 miles in length, to be surfaced with plant-mixed surfacing and shoulders to be constructed. District X, Route 18, Sections E, F, G. Mitty Bros. Construction Co., Los Angeles, \$66,277; J. A. Casson, Hayward, \$68,176; Piazza & Huntley, San Jose, \$68,331; Mountain Construction Co., Sacramento, \$73,858; Pacific States Construction Co., San Francisco, \$84,728; Marshall Hanrahan, Redwood City, \$92,615. Contract awarded to Griffith Co., Los Angeles, \$61,502.25.

MONTEREY COUNTY—About 0.3 mile south of Soledad, ten concrete bridge piers in the Salinas River to be demolished and disposed of. District V, Route 2, Section

D. John Fesler, Santa Maria, \$3,500; C. W. Caletti & Co., San Rafael, \$4,800; Frank Legg, San Francisco, \$6,512; A. A. Tieslau, Berkeley, \$3,470; Lord & Bishop, Sacramento, \$2,750; Granite Construction Co., Ltd., Watsonville, \$5,600; L. C. Seidel, Oakland, \$3,370. Contract awarded to Kiss Crane Service, Southgate, \$1,180.

RIVERSIDE COUNTY—Near Thermal, about 0.9 mile to be graded and roadmix surface treatment applied. District XI, Route 187, Section F. G. W. Ellis, North Hollywood, \$20,611; R. E. Hazard & Sons, San Diego, \$21,087; J. E. Haddock, Ltd., Pasadena, \$21,714; Parish Bros., Los Angeles, \$23,457; M. J. Ruddy, Modesto, \$23,646; Martin & Schmidt, Long Beach, \$24,027; General Construction Co., J. W. Johnson, Los Angeles, \$24,940; V. R. Dennis Construction Co., San Diego, \$25,853; H. H. Peterson, San Diego, \$26,141; R. L. Oakley, Pasadena, \$26,719; S. E. Edmondson & Sons, Los Angeles, \$27,117; Anderson & France, Visalia, \$27,686; C. R. Butterfield-Kennedy Co., San Pedro, \$27,999; C. G. Willis & Sons, Inc., & Chas. G. Willis, Los Angeles, \$28,026; S. M. Milovich, Montebello, \$28,925; B. G. Carroll, San Diego, \$29,154; J. S. Metzger & Son, Los Angeles, \$29,763; Griffith Co., Los Angeles, \$31,101; A. S. Vinnell Co., Alhambra, \$31,914; Valley Construction Co., San Jose, \$34,520. Contract awarded to Basich Bros., Torrance, \$17,742.30.

SAN BERNARDINO COUNTY—Approaches to Santa Ana River bridge east of Colton, about 0.3 mile to be graded and paved with Portland cement concrete. District VIII, Route 26, Section E. T. M. Page, Glendale, \$11,645; S. Edmondson & Sons, Los Angeles, \$12,241; J. E. Haddock, Ltd., Pasadena, \$13,240; Matich Bros., Elsinore, \$14,327; S. M. Milovich, Montebello, \$14,823; Claude Fisher Co., Ltd., Los Angeles, \$14,906; Griffith Co., Los Angeles, \$16,637; A. S. Vinnell Co., Alhambra, \$17,422. Contract awarded to Basich Bros., Torrance, \$11,176.05.

SAN BERNARDINO COUNTY—Between Barstow and one mile north, about 0.9 mile to be graded and surfaced with roadmix surfacing and a reinforced concrete bridge to be constructed. District VIII, Route 31, Section G. B. G. Carroll, San Diego, \$41,455; Parish Bros., Hollywood, \$41,698; Basich Bros., Torrance, \$41,801; R. M. Price, Huntington Park, \$41,937; J. A. Casson, Hayward, \$42,877; M. J. Ruddy, Modesto, \$43,382; J. E. Haddock, Ltd., Pasadena, \$43,852; S. A. Cummings, San Diego, \$45,742; Valley Construction Co., San Jose, \$46,416; C. R. Butterfield-Kennedy Co., San Pedro, \$46,991; Matich Bros., Elsinore, \$47,651; Byerts & Dunn, Los Angeles, \$48,517; Martin & Schmidt, Contractors, Long Beach, \$51,799; R. E. Campbell, Los Angeles, \$52,883. Contract awarded to A. S. Vinnell Co., Alhambra, \$41,255.

SAN DIEGO COUNTY—Application of diesel oil to 68.9 roadside miles of vegetation. Various locations. Square Oil Co., Los Angeles, \$1,300. Contract awarded to R. E. Hazard & Sons, San Diego, \$1,233.

SAN FRANCISCO COUNTY—Between Lake Street and Golden Gate Bridge approach in the City of San Francisco, construction of a viaduct consisting of reinforced concrete girder spans on reinforced concrete bents and retaining wall abutment. District IV, Route 56, Section SF. Clinton Construction Co. of California, San Francisco, \$67,359; Bates & Rogers Construction

Corp., Oakland, \$59,281; Eaton & Smith, San Francisco, \$59,660; E. T. Lesure, Oakland, \$55,484; Robert McCarthy, San Francisco, \$63,176. Contract awarded to Union Paving Co., San Francisco, \$54,441.10.

SANTA CLARA COUNTY—Near northeasterly city limits of San Jose, two bridges, one a reinforced concrete girder bridge across Coyote Creek, consisting of four 42-foot spans and two 14-foot cantilever spans on reinforced concrete piers on concrete piles and the other a reinforced concrete slab bridge across Silver Creek consisting of three 15-foot spans and two 3-foot 6-inch cantilever spans on cast-in-place concrete pile bents. District IV, Route 68, Section B & SJs. Earl W. Heple, San Jose, \$51,614; C. W. Caletti & Co., San Rafael, \$58,293; A. Teichert & Son, Inc., Sacramento, \$59,070; E. T. Lesure, Oakland, \$56,367; Lindgren & Swinerton, Inc., Oakland, \$59,705; Heafey-Moore Co. Fredrickson & Watson Construction Co., Oakland, \$60,660; Eaton & Smith, San Francisco, \$61,321; A. Soda & Son, Oakland, \$63,481; Bates & Rogers Construction Corp., Oakland, \$63,580; Barrett and Hilp, San Francisco, \$61,209; A. J. Raisch, San Jose, \$69,436. Contract awarded to Caputo & Keeble, San Jose, \$51,512.50.

TULARE COUNTY—Across Tule River at south city limits of Porterville, a reinforced concrete continuous slab bridge on reinforced concrete piers with concrete pile foundations to be constructed. District VI, Route 129, Section B. J. S. Metzger & Son, Los Angeles, \$35,100; R. G. Clifford, San Francisco, \$56,545; Earl W. Heple, San Jose, \$37,707; United Concrete Pipe Corp., Los Angeles, \$37,731; M. J. Ruddy, Modesto, \$38,619; Valley Construction Co., San Jose, \$38,889; A. Soda & Son, Oakland, \$39,482; S. A. Cummings, San Diego, \$39,747; R. R. Bishop, Long Beach, \$41,811; B. G. Carroll, San Diego, \$44,906; Case Construction Co., Inc., San Pedro, \$48,529. Contract awarded to Trewhitt-Shields & Fisher, Fresno, \$33,492.60.

NEW LINK IN OCEAN SHORE ROAD

(Continued from page 22)

representing San Francisco County, Alvin Hateh, San Mateo County, and George Ley, Santa Cruz County.

Excellent progress is being made on the construction of this highway, and it is expected that it will be opened to traffic before the contract date for completion, which is December 14, 1939.

"Pop," inquired little Clarence Lilywhite, "what am a millennium?"

"Sho," said the parent. "Doan' you know what a millennium am, chile? It's jes' about de same as a centennial, on'y it's got mo' legs."

Even a stout backbone won't get you anywhere if the knob at the end of it is made of the same material.



Placing excavated material in intermediate zone of upstream embankment section of Shasta Dam. Note bulldozer and sheepfoot roller at left.

Legislation for Central Valley Project Proposed

(Continued from page 23)

being constructed for this unit and the pumping machinery is ready for installation.

The Contra Costa Canal will have a total length of about 46 miles, extending from an arm of the delta near Knightsen to the vicinity of Martinez. With the exception of the first four miles, the canal section will be lined with a three-inch thickness of reinforced concrete. It will have a capacity varying from 350 second feet in the upper end to 256 second feet in the lower end. The remaining 26 miles of this canal are expected to be advertised for bids this year.

Construction work on the remaining units of the Central Valley Project has not as yet been started. These include the second storage unit of the project, Friant Dam and Reservoir on the San Joaquin River, the Friant-Kern and Madera canals, which will divert therefrom and convey water for use in the southern San Joaquin Valley from Madera County on the north to Kern County on the south, the San Joaquin Pumping System, and the Delta Cross Channel. Plans and specifications are being prepared for Friant Dam which will be 300 feet in height and create

a reservoir with a gross storage capacity of 520,000 acre-feet, 70,000 acre-feet of which will be reserved for flood control purposes.

In connection with the San Joaquin River development, substantial progress has been made on the necessary acquisition of water rights. Two contracts with the Miller and Lux interests, which now control a major portion of the present rights to San Joaquin River water, have been negotiated and approved and are ready for execution. One of these contracts provides for the purchase of the so-called grass land rights and the other for the exchange of San Joaquin River water, now used for irrigation of crops, for a substitute supply to be furnished by means of the San Joaquin Pumping System, which will divert the substitute supply from the delta. The recent approval of the "Exchange Contract" by the State Railroad Commission is the last step required preparatory to the execution of both of these contracts. Negotiations are progressing for the acquisition of numerous other water rights.

Other important negotiations still under way in connection with the Friant Dam unit comprise those with

the Madera and Fresno Irrigation districts for the acquisition of whatever rights or properties those districts may have in the Friant Dam and Reservoir sites. It is reported the negotiations are nearing completion with the Madera Irrigation District.

Walker R. Young, supervising engineer for the Bureau of Reclamation, states that additional construction work on the Central Valley Project now in prospect for early bidding includes Friant Dam, the upper sections of the Friant-Kern and Madera canals, the remainder of the Contra Costa Canal and more railroad and highway relocation around Shasta Reservoir, including the huge Pit River Bridge.

The bypass tunnel through which the Southern Pacific Railroad tracks will be diverted pending the completion of the railroad realignment at a higher elevation around the Shasta reservoir, was holed through on March 4.

The tunnel, which is 1,820 feet long, is being lined with concrete from 18 to 21 inches thick throughout its entire length and it is expected it will be completed and open to traffic sometime in July.

Western Families 'Own the Roads' Says Dr. Hewes

IN HIS address before the joint meeting of the annual conventions of the American Road Builders' Association, the Associated General Contractors of America, and the Western Association of State Highway Officials recently held in San Francisco, Dr. L. I. Hewes, Deputy Chief Engineer, U. S. Bureau of Public Roads, in discussing highway problems of today, said:

"In its position as a clearing house for the several state-wide highway planning surveys, the Bureau of Public Roads is obligated morally to make public as fast as possible general data that become visible when the highway planning surveys of the several States are combined.

"The bureau is doing such publicity work. Thus, in considering farm-to-market roads, it is seen that only 10 per cent of the total highway movement is served by county and local roads. Yet such movement requires 78 per cent of the total mileage. Similarly, local city streets serve generally only about 6 per cent of the total traffic."

"The increase in highway transportation in the western States in the last 18 years is apparent from a study of figures for motor vehicle registration and the gasoline tax dollar for the eleven western States between 1921 and 1938.

"In the year 1937 alone, the western road users paid in State license fees and gasoline taxes approximately \$152,256,000. * * *

OWN THE ROADS

"The 1938 western registrations indicate about 4.6 million vehicles. Family ownership of vehicles thus just about accounts for the total western population. So the western families, as such, actually may be said to own the roads.

"In the country as a whole, the ownership of family passenger cars is largely by people of very moderate incomes. Less than 5 per cent of the passenger cars are owned by people with incomes of \$5,000 per year or more. The Bureau of Foreign and Domestic Commerce in the United States Department of Commerce re-

Bay Bridge Traffic Shows Increase of 1700 Vehicles Daily Over March

APRIL TRAFFIC on the San Francisco-Oakland Bay Bridge piled up a daily average of 28,311 vehicles, it was revealed yesterday by State Department of Public Works Director Frank W. Clark in a report filed with Governor Culbert L. Olson.

The figure represents an increase of approximately 1700 vehicles per day over March and an increase of over 5,000 vehicles per day over the same period a year ago. April's daily average marks the third highest since the bridge opened, except for the first two weeks of November, 1936.

Total traffic for April was 849,317 vehicles, bringing the year's total to 3,172,113 and the total since the bridge opened to 22,233,202. Highest day of the month was Sunday, April 9, when 39,700 vehicles crossed the span.

April's revenues amounted to \$439,521.16.

Of last month's total 169,806 vehicles went to Treasure Island, Mr. Clark's report said. Traffic from San Francisco to Treasure Island totaled 89,917 vehicles and from the East Bay, 79,889.

Convenience of automobile travel to Treasure Island, Mr. Clark said, accounted for the heavy exposition traffic, which is exceeding original estimates.

April totals and comparative figures follow:

	April 1939	March 1939	Total 1939 to date	Total since opening
Passenger Autos and Auto Trailers	767,327	738,813	2,846,922	20,554,594
Motorcycles and Tricars-----	3,467	3,037	12,147	99,046
Buses -----	8,270	7,384	31,943	279,577
Trucks and Truck Trailers-----	44,790	47,138	182,411	942,310
Toll Vehicles -----	823,854	796,372	3,073,423	21,875,527
Passes -----	25,463	26,542	98,590	357,675
Total Vehicles -----	849,317	822,914	3,172,013	22,233,202
Extra Passengers -----	296,604	259,266	995,324	5,743,959
Freight Tons -----	54,830	59,981	244,478	1,155,608

cently found that more than half the family cars were owned by families with annual incomes of \$1,500 or less.

"We thus arrive at a rather astounding fact: namely, that since 1918 motorists, of whom nearly 96 per cent have less than \$5,000 incomes, have supplied the United States with its system of main highways. The details of family ownership are shown in the following tabulation:

OWNERSHIP OF FAMILY CARS BY ANNUAL INCOME GROUPS

Annual income bracket Dollars	Percentage of family pas- senger cars owned in each income bracket	Percentage of family car owners with income less than the maximum of each income bracket
Under 500 -----	6.54	6.54
500-1,000 -----	20.55	27.09
1,000-1,500 -----	24.77	51.86
1,500-2,000 -----	18.07	69.93
2,000-3,000 -----	17.73	87.66
3,000-5,000 -----	8.02	95.68
Over 5,000 -----	4.32	100.00

Yet people still get thin worrying, excepting when they are worrying about being fat.

New State Highway Nearing Completion

(Continued from page 18)

eral aggregates for the crusher run base and plant-mixed surfacing were obtained by crushing material from a mine dump 1½ miles west of Colfax.

One of the features of the construction was the securing of 10,000 cubic yards of selected material from the roadway prism on the projected ultimate alignment. The contractor has arranged for the removal of this material by bulldozing and trapping the material in a bunker for loading into trucks instead of the more common method of loading with a shovel.

The contractors for the road construction are Piazza and Huntley of San Jose and the Resident Engineer is H. O. Ragan.

This is a Federal Aid project, and the total cost of the road construction is \$46,500.

Six Highway "Musts" Stated by MacDonald

IN CLOSING his address at the Dallas Convention of the American Association of State Highway Officials, Thos. H. MacDonald, Chief of the Bureau of Public Roads, stated that based on the highway planning surveys, we must have:

First, a reclassification of our highways;

Second, a provision for roads to serve all types of existing or developing traffic, and recognizing the fast, through traffic as distinct from local use;

Third, the beginning of special motor roads in congested areas leading from the hearts of the cities through metropolitan areas, designed to permit free flow of traffic separated from cross-traffic;

Fourth, the organization of a big mileage of local land-service roads to be brought rapidly to usable condition;

Fifth, the program of State and Federal-aid systems which lies between, on which work must continue with a constantly higher level of design standards for safe traffic service; and

Sixth, for these improvements, a radically new policy of land acquisition to be formulated and made effective in order to provide adequate space and to control unsightly and undesirable ribbon development.

These, he states, are partial details of a future program indicated by the data of the highway planning surveys, if these data are to be used intelligently in the immediate future.

Swing Spans Feature Arch

(Continued from page 10)

forcing steel were 1000 pounds per square inch and 18,000 pounds per square inch, respectively. An exceedingly high grade concrete was manufactured for the project; 28 day strengths ran as high as 6000 pounds per square inch.

The Contractor was C. O. Sparks and Mundo Engineering Company, and I. T. Johnson, Resident Engineer.

In Memoriam HOWARD SPENCER HAZEN

The Division of Architecture suffered a great loss April 13, 1939, in the death of Howard Spencer Hazen, who had served as senior architectural designer in the office of that division since 1926.

Mr. Hazen was born in LaSalle, Illinois, educated in the schools of that community, and graduated in Civil Engineering from the University of Illinois. Becoming interested in architecture, he pursued the study of this subject at the Massachusetts Institute of Technology in Boston and later at Harvard University.

His professional career covered a wide field of activity, first in Boston and later in Chicago.

In 1924, he came to Sacramento at the instance of James S. Dean of Dean & Dean, Architects, and was associated with that firm in the design of many important structures, including the Sacramento Memorial Auditorium, the Sacramento Junior College, and the Westminster Presbyterian Church.

In the office of the Division of Architecture he was responsible for the design of several complete State institutional groups, of which the San Diego State College, the Camarillo State Hospital, and the California Institution for Women are outstanding examples.

Always self-effacing, he was possessed of cultural attainments beyond the knowledge of any except those most intimately acquainted with him. Art, music, literature, and science shared in the use of his leisure moments without excluding the friendly human touch or the keen sense of humor so deeply appreciated by all who knew him. A great void exists where he once stood.

25,000 Miles of 4-Lane Highways Need in 25 Years

(Continued from page 10)

"Based on information gathered in the highway planning surveys, however, it is now apparent that 25,000 miles of new four-lane highways may have to be built in the next 25 years to accommodate the automobile traffic of the nation. This is an average of 1000 miles of new construction each year in addition to the existing mileage of the multiple-lane type now in use. Therefore, the sectional lay-out of multiple-lane highways is increasingly important."

Grade Separation Projects Total \$11,000,000

(Continued from page 14)

for which were in many cases much less complete than we would have desired, the contractors have cooperated to the end that we have secured very satisfactory jobs and the claims for additional compensation were reduced to a minimum.

The local district office of the Bureau of Public Roads was also an important factor in accomplishing the work under these programs. Their representatives were always available for consultation and furnished invaluable assistance in programming, designing, and constructing the grade separation projects.

Without such splendid cooperation all over California through the last four years, the State would have been hampered in getting this large program under way.

With the two earlier programs nearing completion, we are now in the process of formulating a program to utilize with the greatest possible benefit the allocation of about \$1,800,000 to be spent during the 1940-1941 Fiscal Years. It appears that with this money there will be added to the previous sixty-eight projects about ten additional separations.

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Gentlemen:

We are very much interested in obtaining copies of "California Highways and Public Works" for use as references by our staff of the Joint Highway Research Project. We are doing research work on various highway problems under a cooperative agreement between Purdue University and the Indiana Highway Commission. As a result, we would appreciate being placed on the mailing list for the above mentioned publication.

Very truly yours,

(Signed)

K. B. Woods
Assistant Director

State of California

CULBERT L. OLSON, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

FRANK W. CLARK, Director of Public Works

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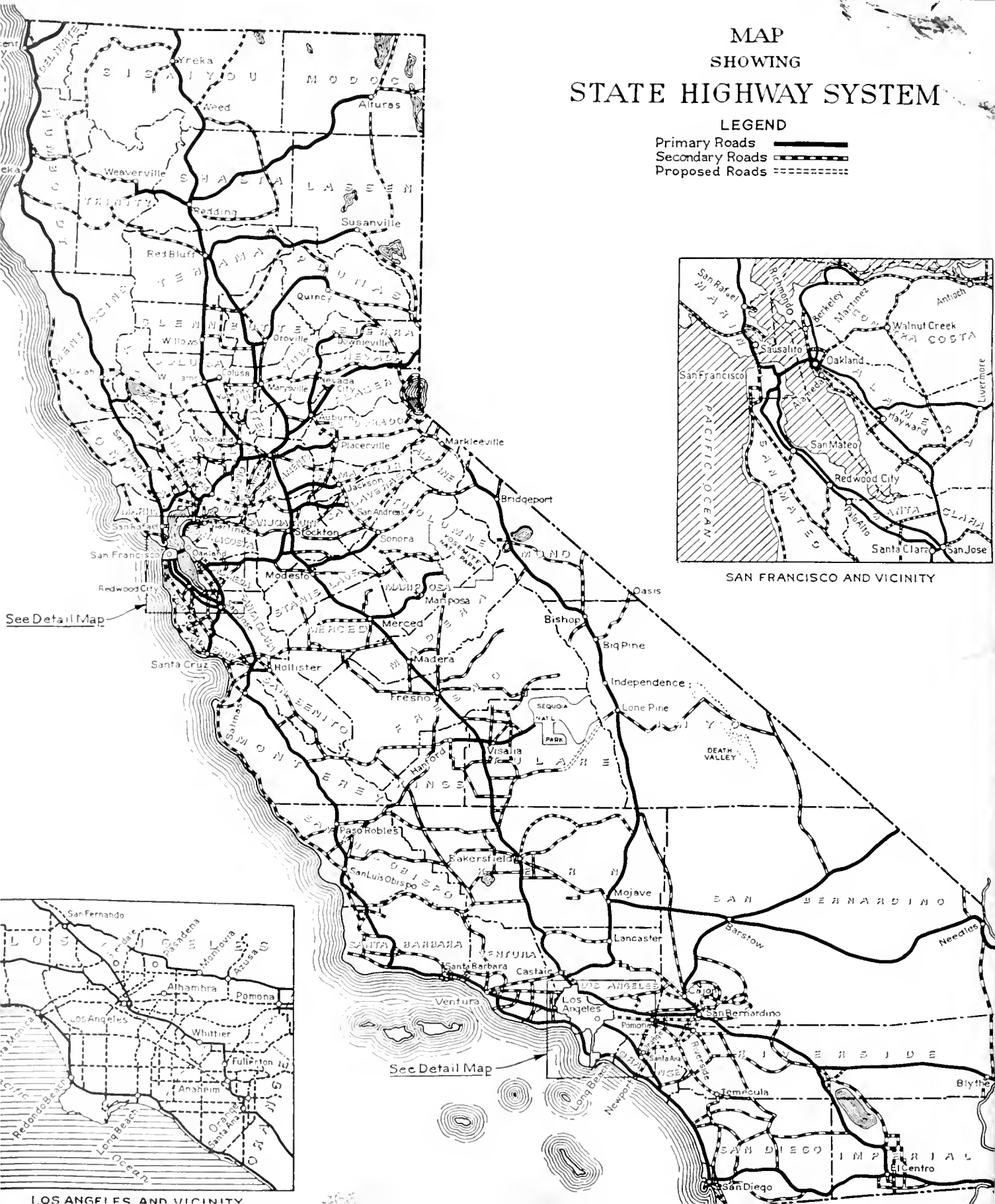
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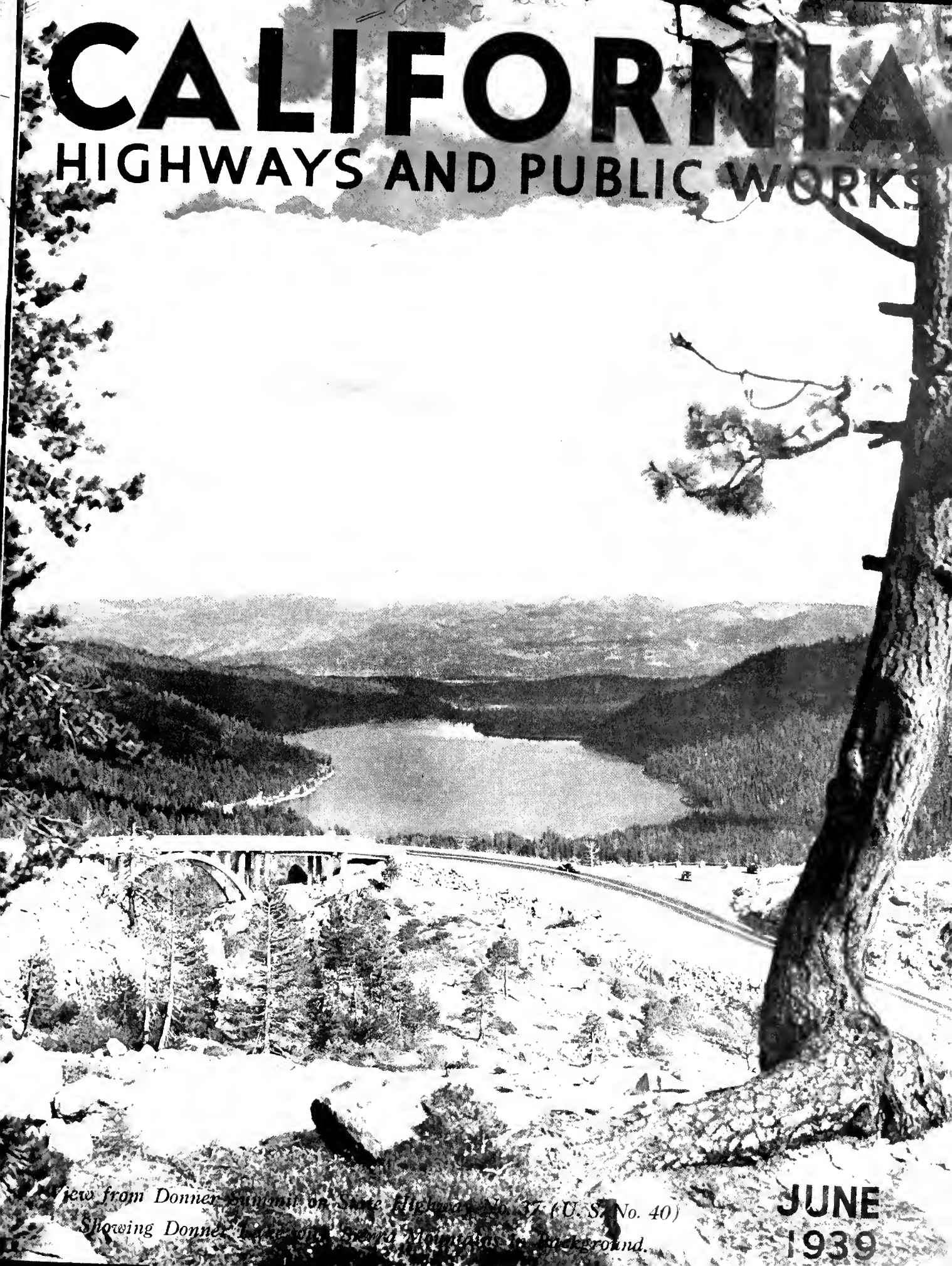
LEGEND

Primary Roads —————
Secondary Roads - - - - -
Proposed Roads



CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



View from Donner Summit on State Highway No. 37 (U. S. No. 40)
Showing Donner Lake and Sierra Mountains in Background.

JUNE
1939

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

Published for information of the members of the department and the citizens of California

Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request

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JUNE, 1939

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Governor Olson Accomplishes a Reduction in Toll Rates on the San Francisco-Oakland Bridge

UPON the initiation by and under the leadership of Governor Culbert Olson, a transaction has been completed with the Reconstruction Finance Corporation and a syndicate of underwriters which has reduced the indebtedness of the San Francisco-Oakland Bay Bridge and the rate of interest on that indebtedness, and certain of the annual payments thereon, thus making it possible for a reduction of the tolls on the San Francisco-Oakland Bay Bridge from fifty cents to forty cents, and a reduction of 20 per cent of the commutation rates.

About the fifteenth of May Governor Olson telephoned Jesse Jones, Chairman of the Reconstruction Finance Corporation, and advised him that he was sending Frank W. Clark, State Director of Public Works, and Messrs. Herbert W. Erskine and Edward P. Murphy, attorneys for the California Toll Bridge Authority, to Washington immediately for the purpose of discussing arrangements which would lead to a prompt reduction of the tolls on the San Francisco-Oakland Bay Bridge.

On May 18th Mr. Clark, accompanied by Mr. Erskine and Mr. Murphy, embarked for Washington by airplane, and arrived there May 19th. Negotiations then occurred between them and Mr. Jones and other officials of the Reconstruction Finance Corporation and attorneys and officials of the underwriters. Finally the following arrangement was worked out by Mr. Clark and these attorneys with the other groups, and Mr. Clark then returned to San Francisco, leaving the details and the contracts to be completed by the attorneys. The net results of these negotiations were the following:

1. Reduction of the rate of interest on the \$40,000,000 San Francisco-Oakland Toll Bridge Sinking Fund Revenue bonds from $4\frac{1}{4}$ per cent to 4 per cent, thus saving the

New Toll Rates

The reduced toll rates on the San Francisco-Oakland Bay Bridge adopted by the California Toll Bridge Authority are as follows:

Automobile with 4 passengers and driver, 40¢ reduced from 50¢

Present \$17 commute books reduced to \$14.00.

Present \$14 commute books reduced to \$11.60

Reduction in the toll to Treasure Island will make the rate 40 cents for round trip from either end of the bridge.

Reduced rates on commute books will also apply to round trip to Treasure Island.

Toll Bridge Authority \$100,000 per annum in interest charges;

2. Allowance to the Toll Bridge Authority of \$1,065,000 as its share of the profit derived by the Reconstruction Finance Corporation from the sale of the bonds to the underwriters;

3. Use of said profit plus \$500,000 in the hands of the Authority, which was not needed for construction purposes, to redeem \$1,500,000 of said revenue bonds at a premium of $2\frac{1}{2}$ per cent rather than the premium of 6 per cent provided for in the bonds, thus again saving the Authority \$52,000 in the redemption cost of the bonds and reducing the Toll Bridge indebtedness to \$71,000,000, thereby saving the interest on the \$1,500,000 of bonds so redeemed, which is \$60,000 per annum.

The application of this \$1,500,000 to the payment and redemption of certain of the bonds outstanding reduced the yearly payments for the

next several years, so as to decrease the bond service requirements to a point which made it possible to reduce the rates of tolls and still comply with the bond service requirements.

It is confidently expected by the Governor and Mr. Clark and the counsel for the Authority that this reduction in bond service requirements will make it possible before the end of the year 1939 to reduce the bridge toll to thirty-five cents.

It is expected that the reduction to forty cents and the later reduction to thirty-five cents will make it impossible for the vehicular ferries to continue their present competition with the bridge. The existence of this competition has been the leading factor in preventing toll reductions.

As soon as this factor is eliminated it is confidently hoped that the tolls may again be reduced even as low as twenty-five cents.

After Mr. Clark's return to California, Mr. Erskine and Mr. Murphy, counsel for the Authority, then proceeded to New York, where the complicated agreements and documents setting forth the transaction were drawn by them in collaboration with the attorneys for the underwriters and the Reconstruction Finance Corporation. These were completed on Friday, June 2d, and Messrs. Erskine and Murphy immediately left New York by plane and arrived in San Francisco Saturday, June 3d. The members of the Toll Bridge Authority met on Monday morning, and passed the necessary resolutions to make the transactions effective. The papers were then airmailed to Washington and were executed there by the Reconstruction Finance Corporation and by the underwriters and the transaction thus was successfully concluded.

As this magazine went to press it was expected the toll rate of forty cents per vehicle would go into full



California Toll Bridge Authority that adopted reduced rates on San Francisco-Oakland Bay Bridge. Left to right, seated, Lawrence Barrett, Chairman California State Highway Commission; Director of Public Works Frank W. Clark, Secretary, Toll Bridge Authority; Governor Culbert L. Olson, Chairman of the Board; Lieutenant Governor Ellis E. Patterson; Phil S. Gibson, Director of Finance. Standing, left to right, Charles H. Purcell, State Highway Engineer; Edward P. Murphy, Attorney for the Board; Hubert W. Erskine, Attorney for the Board; C. C. Carleton, Chief of the Division of Contracts and Rights of Way, Department of Public Works.

effect on or about the fifteenth of June.

It is interesting to note that in November of last year it was announced that it would be approximately three years before there could be any reduction in the tolls. Governor Olson, Mr. Clark, and the attorneys, Mr. Erskine and Mr. Murphy, are accordingly being congratulated upon this splendid achievement due entirely to the initiative and efforts of Governor Olson aided by the co-operation of Director Clark, and the attorneys for the Authority.

The people of the State of California, particularly those residing in the Bay area feel elated and are expressing their appreciation to the administration for the results so quickly and so efficiently obtained.

Following the action by the Toll Bridge Authority, Chairman Jesse H.

Jones of the Reconstruction Finance Corporation announced the sale on June 7 of \$71,000,000 of San Francisco-Oakland Bay Bridge bonds to a group of New York bankers. The bonds, known as 4 per cent revenue bonds, were sold at a price of 104 per cent of the face value plus accrued interest which, Jones said, represented a premium to the Reconstruction Finance Corporation of \$2,840,000.

Another purchaser of the bonds was L. J. Mattox, State Industrial Accident Commissioner, who announced that the commission voted to invest \$5,000,000 of the Workmen's Compensation Fund which now totals about \$17,000,000.

During the month of May, a total of 847,925 vehicles crossed the bridge, according to a traffic report submitted by Director Frank W. Clark to Gov-

ernor Olson. This figure represents an increase of approximately 120,000 vehicles over the same period a year ago and brings the total number of vehicles to travel over the span since its opening November 12, 1936, to 23,081,127.

During the month a daily average of 27,352 vehicles used the bridge, which includes an increase over April of approximately 3,000 trucks. The total number of trucks using the

(Continued on page 5)

An aerial photo of San Francisco-Oakland Bay Bridge on the adjoining page shows the full 8½ mile-length of the great structure, on which the toll for automobile with driver and four passengers has been reduced to forty cents. In the foreground may be seen the San Francisco end at Fifth Street Plaza and the bridge train terminal. At Yerba Buena Island in the middle ground a highway lateral and viaduct extends to Treasure Island shown at extreme left.



Work on Presidio Approach to Golden Gate Bridge Speeds Up

By T. E. FERNEAU, Resident Engineer

EARLY in 1935 negotiations were started to obtain a permit for constructing an approach to the Golden Gate Bridge through the Presidio of San Francisco. The Golden Gate Bridge and Highway District and the city of San Francisco conducted these early negotiations, while the Division of Highways took no active part. Early in 1937 it was agreed that the work should be done by the Division of Highways and negotiations with the military authorities were assumed by the Division. The greater portion of the negotiations were carried on personally by Col. Jno. H. Skeggs, District Engineer of District IV.

Many major and minor difficulties had to be met and dealt with before the U. S. Army authorities issued a permit on July 27, 1938, allowing construction of the highway within the Presidio.

The new approach is to extend from the intersection of Lake Street

and Park-Presidio Boulevard on the south side of the Presidio to the Marina approach to the Golden Gate Bridge. The length of the main approach is 1.44 miles, but with the addition of two off ramps and two on ramps at the bridge connection the length will total 2.10 miles. Of this length 2.03 miles are located within the Presidio boundaries.

APPROACH IS FREEWAY

A requirement of the Army permit is that the approach be a freeway through the Presidio with no access except at the termini.

In two instances where Presidio roads cross the new alignment, relocations of the roads are to be made passing under the new viaducts. Right of way is limited to toe of slope in cuts, top of embankment in fill, exterior faces of retaining walls and outer railing of viaducts. However, the Division of Highways is required to plant and permanently

maintain all slopes outside the actual right of way lines. Title to ground underneath all viaducts and over a section of road in tunnel remains with the Army.

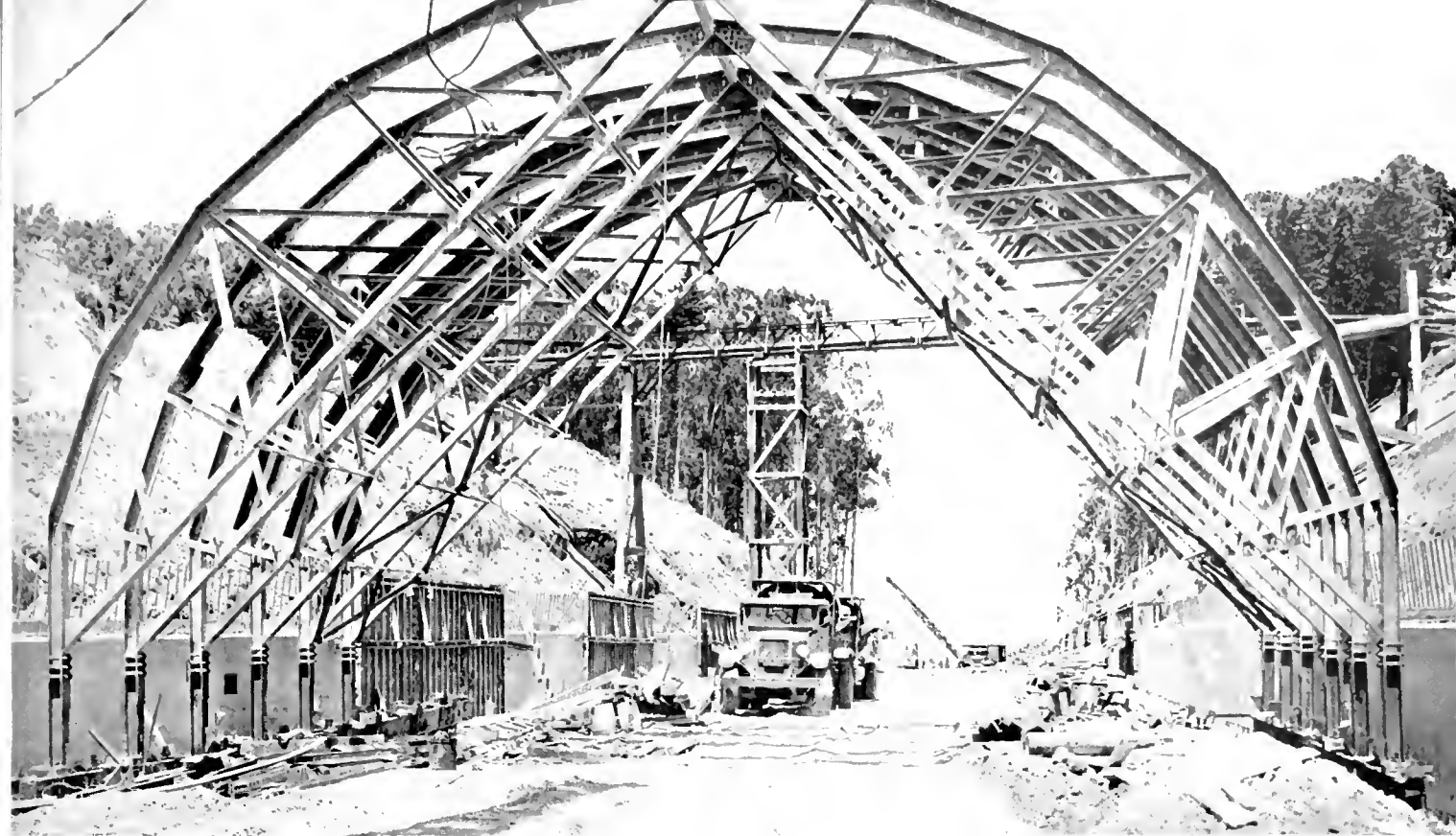
Distribution and segregation of traffic from the new highway to and from the Marina approach to the Golden Gate Bridge is to be handled by two on, and two off ramps, all of two-lane roadways. These distribution roads permit vehicles coming from any direction to turn towards their ultimate destination without crossing another traffic stream. No pedestrian facilities will be provided, although it is necessary to construct two pedestrian underpasses for relocations of the sidewalk on the existing Marina approach to the Golden Gate Bridge.

COST IS \$1,500,000

Financing is provided from gas tax funds and a PWA grant of \$800,000 accepted by the State on August 19, 1938.

General view of main Funston Avenue approach to Golden Gate bridge through Presidio looking south from intersection of all traffic distribution ramps.





Erecting steel form jumbo preparatory to pouring arch for tunnel under Presidio golf course and Washington Boulevard.

The cost of the entire project was originally estimated at \$1,789,100. Savings of nearly \$330,000 have been made in bids on four contracts to date, and it now appears that the completed project will cost less than \$1,500,000.

The various phases of construction have been divided into units as follows:

Type of work	Contractor	Per cent com- plete May 27, 1939	Estimated com- pletion Date
Grading and 1300 ft. of tunnel	Macco Construction Co.	31	Dec., 1939
Three viaducts totaling 1288 ft.	Union Paving Co. "A," "B" and "C"	20	Dec., 1939
Highway underpass—2 pedestrian underpasses	M. J. Lynch "D," "G" and "H" and Viad. "E"	0	Dec., 1939
238 ft. viaduct	Union Paving Co. Viad. "F"	6	Nov., 1939
Paving entire project	Not under contract	0	Feb., 1940
Land-scaping	Not under contract	0	Mar., 1940

1300-FOOT TUNNEL

A unique feature of the work is a 1300-foot 4-lane tunnel being constructed by the open cut and backfill method. The material taken from the tunnel cut was used to overload a section of fill on marshy ground skirt-

ing the edge of Mountain Lake. The fill was built up nearly twenty feet above grade, resulting in displacement of the marsh mud until the highway fill now rests on firm foundation. The material thus stock piled as overload will later be used to back-

Governor Olson Accomplishes a Reduction in Toll Rates on San Francisco-Oakland Bridge

(Continued from page 2)

bridge in May was 47,352 continuing the definite trend of increased truck travel noticeable during the past year. May also showed an increase over the previous month in the amount of freight transported over the bridge with 59,345 tons as against 54,830 tons for April.

Revenues for the month of May amount to \$439,738.42. The report also revealed that a total of 153,424 vehicles traveled to Treasure Island via the bridge. Traffic from San Francisco to the island totaled 80,606 and from the east bay 72,818. May traffic totals and comparative figures are as follows:

	April, 1939	May, 1939	Total, 1939	Total since opening
Passenger Autos and Auto Trailers.....	767,327	761,650	3,608,572	21,316,244
Motorcycles and Tricars.....	3,467	3,759	15,906	102,805
Buses	8,270	8,929	40,872	288,506
Trucks and Truck Trailers.....	44,790	47,352	299,763	989,662
Toll vehicles	823,854	821,690	3,895,113	22,697,217
Passes	25,463	26,235	124,825	383,910
Total vehicles	849,317	847,925	4,019,938	23,081,127
Extra passengers	296,604	317,347	1,312,671	6,061,306
Freight tons	54,830	59,345	303,823	1,214,953



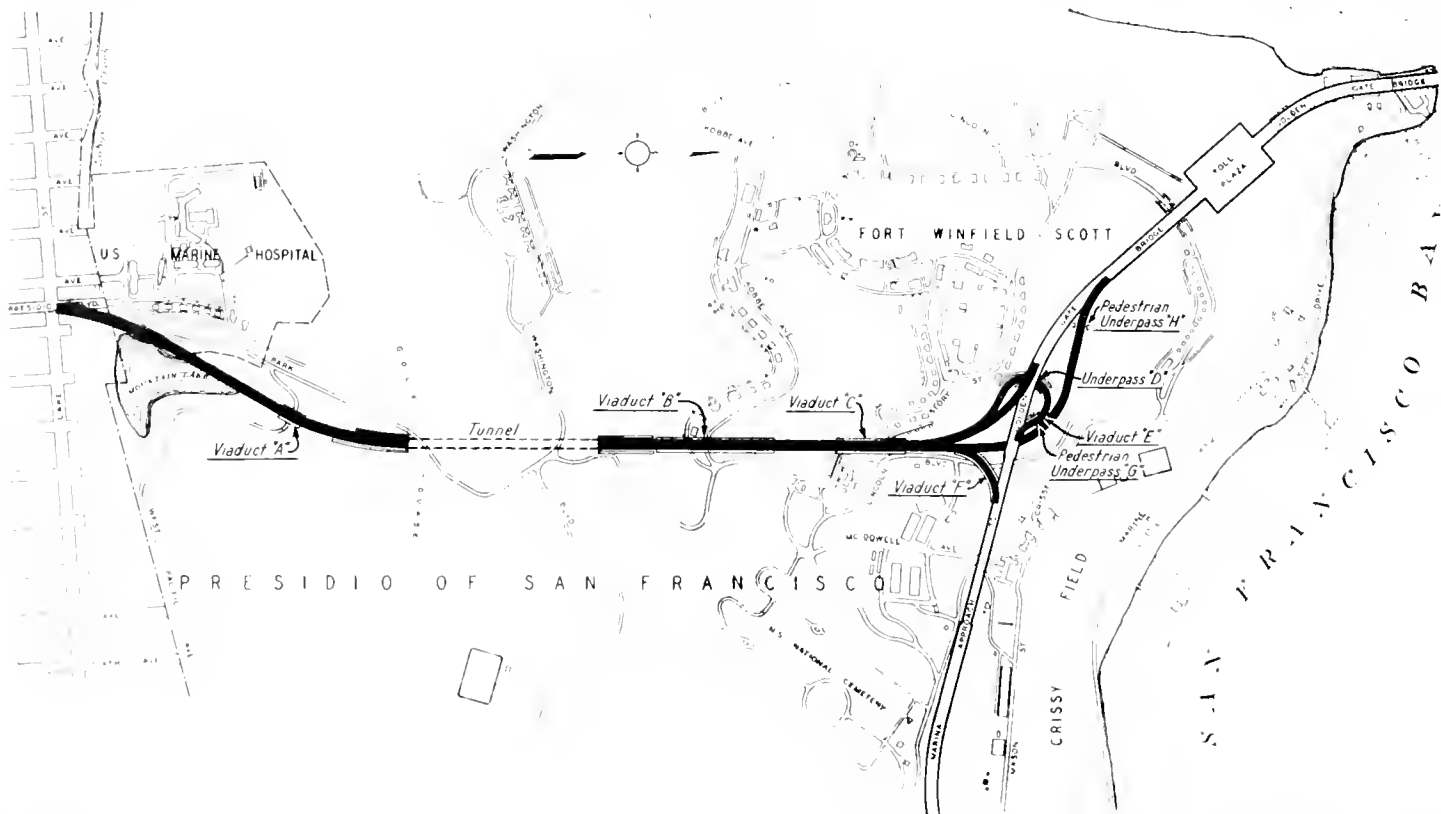
Pouring tunnel sidewall blocks. The tunnel, 1300 feet long, is being constructed by open cut and backfill method.

fill the tunnel and tunnel retaining walls.

The length of this tunnel, 1300 feet, approaches the practical limit of

length without requiring forced ventilation equipment. The odorless but noxious carbon monoxide gas from automobile exhaust can not be per-

mitted to exceed concentrations of 4 parts in 10,000 for any extended period of time. It is very doubtful if gases would ever be present in this



tunnel in dangerous concentrations, but ventilation is provided by a 24-foot by 24-foot shaft to the surface about midway of the length. If ever found necessary, exhaust fans will be placed in this shaft to provide forced ventilation by drawing fresh air in at both portals and exhausting it up the shaft.

NO DRAINAGE FROM HIGHWAY

Another unusual feature of the project is that no drainage from the highway can be permitted to flow onto the Presidio grounds or into any of the existing Presidio facilities.

This limitation necessitates construction of a master drain system which carries all drainage water to Mountain Lake at the south end of the project and to the San Francisco Bay at the north end. Across the various viaducts the drainage is carried in special pipes suspended beneath the deck.

Viaducts are of reinforced concrete construction. All are designed as rigid frame continuous girder types.

The roadway from the beginning of the project at Lake Street to the first viaduct, a distance of 1500 feet will have two 24-foot lanes separated by a center parting strip 6 feet wide. From there to the traffic distribution roadways the roadway, including viaducts, will have two 22-foot lanes separated by a center parting strip

A Good Samaritan

May 13th, 1939

Mt. Hermon,
California

The Division of Highways
Sacramento, California

My Dear Sirs:

Just a kindly word of commendation for the foreman of your San Lucas division who today found two elderly people in trouble with their car and unable to adjust themselves. He corrected the trouble and soon had them on their way, and flatly refused any compensation for the splendid help rendered. Therefore we desire again to thank a man whose name we do not have. Also the higher ups who select such men to service.

Sincerely yours,
MR. and MRS. A. R. TAYLOR
Mt. Hermon

18 inches wide. Except through the tunnel and across viaducts, shoulders 9 feet 6 inches wide will be provided.

The traffic distribution roadways including structures will have a road-

way width of 24 feet between curbs.

An interesting feature of the work is caring for golf course facilities near the tunnel cut. Two tees and one green were moved to temporary locations away from the work and a foot bridge for the golfers was constructed over the tunnel cut. These facilities must be returned to their original location after the tunnel backfill is completed.

Progress on the work has been good. Grading work is nearly completed. Foundation work for all viaducts is nearly completed and superstructure construction is in progress. At the tunnel, footings and sidewalks are completed and pouring of the concrete tunnel arch is scheduled to start immediately. The arch will be poured by using steel form jumbos, traveling on rails. These form jumbos are now being erected in preparation for the first arch pour.

At present, about 275 men are regularly employed at the site of the work and it is expected this force will be increased as additional units of work are placed under contract.

Approximate quantities of major items and materials which will be used for the entire project are:

Roadway Excavation	310,000 cu. yds.
Concrete	40,000 cu. yds.
Reinforcing Steel	2,500 tons
Crusher Run Base	10,000 tons
Drainage Pipes	21,000 lineal feet

Pouring last section of the deck of Viaduct "A" which carries the approach highway over West Pacific arterial in the Presidio.





Realignment and modernization of the highway through Nojoqui Canyon involved the construction of several rock cuts and four bridges. Note how the bridge over Nojoqui Creek in the above picture conforms perfectly to the width and curvature of the roadway.

Nojoqui Canyon Abolished

By L. H. GIBBS

THE combined highway and bridge project between Gaviota Pass and the Santa Ynez River in Santa Barbara County, recently completed, adds another link of modernized highway to the Coast Route between San Francisco and Los Angeles.

The new road replaces an old pavement that contained many dangerous combinations of sharp curvature and blind vertical curves, and retains the sylvan charm afforded by the groves of beautiful live oak trees. Nineteen curves have been eliminated.

Contract for constructing the project was awarded to C. O. Sparks and Mundo Engineering Corporation on April 25, 1938. The major items of work involved grading a 36-foot roadbed, placing a blanket of selected imported borrow river gravel thereon, constructing a 22-foot width of Portland cement concrete pavement and constructing four reinforced concrete bridges, each approximately 120 feet long.

ROCK CUTS BLASTED

Contract work got under way early in May, 1938. After clearing had sufficiently progressed, the contractor started grading operations, using bulldozers for pioneering and three 13-cubic yard carryall outfits for moving.

Two rock cuts proved too difficult for rooters and carryalls; it was necessary to loosen up the material with approximately 0.4 pound of powder per cubic yard and then move it by 1-cubic yard shovel and trucks. Very few slides of any consequence occurred on the job.

Construction of the four bridges began very early in the contract. Each of the bridges, identical in type and almost identical in length, are rigid frame type, 26 feet clear width; central span is 46 feet with cantilevered span 9 feet long at each end; each cantilever supports a suspended span 26 feet long; the other end of each suspended span is

Realignment 9 Curves

District Engineer

supported on a steel bearing plate mounted on an abutment. Overall length of the bridges varies from 120 feet to 121 feet 5 inches depending on whether built on tangent or curve.

UNSTABLE SOIL CONDITIONS

The contractor early experienced difficulty in the bridge construction. Upon excavating for foundations, unexpected unstable conditions were encountered, which required the lowering of footings from 4 to 8 feet. Considerable delay was caused by this unlooked for condition.

Forms for bridge work were largely constructed of 3-ply plywood, backed by 1 by 6-inch and 2 by 4-inch struts and wales. The better-than-average form work aided in obtaining a very good finish on the structures.

Bearing values of soils encountered in the cuts were generally so low that it was necessary to place better material as a sub-base for the pavement. A river gravel of suitable quality obtained from the bed of the Santa Ynez River about 500 feet right of Station 263, was spread on the prepared subgrade to a maximum depth of 0.70 foot below pavement; shoulders were blanketed with 0.75-foot thickness.

MEMBRANE SEAL PLACED

As a precaution against reducing the bearing value of the river gravel subbase by absorption of capillary water from below, an impervious membrane seal, consisting of Grade "E" asphalt was spread on the subgrade at the rate of 0.7 gallons per square yard.

After unsatisfactory preliminary trials to eliminate oversize in the pit run imported borrow by screening through a sloping grizzly set on the truck body, the contractor brought in a crushing and screening plant of 100 tons per hour capacity.

(Continued on page 26)



A section of the new State highway through Nojoqui Canyon which eliminates 19 curves between Gaviota Pass and Santa Ynez River in Santa Barbara County. Part of the narrow, tortuous old route is seen crossing the new highway in the middle ground.



Completed section of Arroyo Seco Parkway beginning at Glenarm Street in Pasadena. Designed as a "freeway" it has six lanes divided by a raised separation strip and no stop lights or intersections in its nine-mile length between Pasadena and Los Angeles.

Arroyo Seco 6-Lane Freeway

By S. V. CORTELYOU, District Engineer

WITH four contracts completed and three contracts now under way, the Arroyo Seco Parkway, which is to connect downtown Los Angeles with Pasadena and other points to the north and east, is well on its way toward realization. The distance from the business district of Pasadena to downtown Los Angeles via this new route will be nine miles, about six miles of which will be new construction by the State.

Designed as a "Freeway," this highway will enable traffic to pass from the Figueroa Street tunnels in Los Angeles to Broadway and Glenarm Street in Pasadena without encountering a single stop light, intersecting street or railroad grade crossing.

Three wide traffic lanes will be provided for traffic in each direction, separated in the center by a raised dividing strip which will make it impossible to make left turns across traffic or to meet opposing traffic "head on."

Access to the "Parkway" will be had at intervals by means of modified "clover leaf" intersections on which only right hand turns from the "Parkway" may be made. Each of these intersections is being carefully designed to conform to its particular topographic features and traffic requirements.

SERVICE ROADS PROVIDED

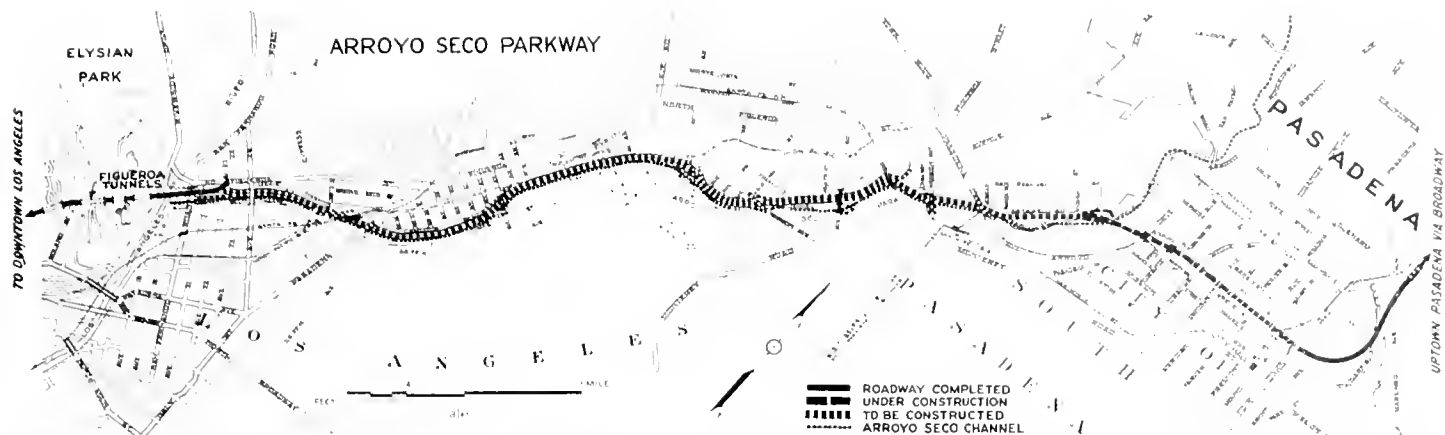
Adjoining privately owned property will not have direct access to the "Parkway" but will front on service roads paralleling the highway. These service roads will connect with the "Parkway" at suitable intervals by means of one way ramps.

Accelerating and decelerating lanes will be provided at each of these ramps to permit entering traffic to "speed up" to the legal speed of traffic on the "Parkway" before entering one of the main traffic lanes and to permit traffic leaving the "Parkway" to "slow down" on an additional traffic lane before turning off of the main highway. These

safety provisions are in accordance with accepted "Freeway" design and will result in a minimum of interference with "Parkway" traffic.

The "Parkway" between Hough Street and Avenue 26 in Los Angeles, will follow the northwesterly side of the Arroyo Seco Channel, being depressed to permit all intersecting streets and railroads to cross on overhead bridges. Near Hough Street, in Los Angeles, the alignment enters the city of South Pasadena, crossing the Arroyo Seco Channel on a bridge which is now under construction.

Thence the "Parkway" runs easterly along Sterling Place and Grevelia Street on a depressed grade which will be about 20 feet below natural ground elevation from Arroyo Drive to Fair Oaks Avenue. Just easterly of Fair Oaks Avenue the grade ascends to approximate ground level curving northerly around Raymond Hill and entering the city of Pasadena on Broadway. Actual construction work by the State ends at the intersection of Glenarm Street and



Broadway in Pasadena, from which point connection is made with the business district of Pasadena via Broadway, which is already a wide, improved street.

The Arroyo Seco Parkway in Los Angeles from Avenue 22 to Hough Street near the south city limit of South Pasadena is located for the greater part of the distance adjoining and parallel to the Arroyo Seco Channel, which is paved and walled for the entire distance. The grade of the highway can thus be established at critical points somewhat lower than

the banks of the channel to permit crossings of intersecting streets and railroads to be made on overhead bridges at a minimum of expense.

Comparatively little damage to adjoining property results from this location which follows through city of Los Angeles park lands for a considerable portion of the distance. On the contrary, a large number of citizens will drive every day through beautified park areas and the city thus secure a maximum beneficial use of the long narrow park.

An interesting side light in the con-

struction of the "Parkway" is the recent utilization for the construction of highway embankments of more than 170,000 cubic yards of material excavated from the bed of the Los Angeles River near Dayton Avenue. This was material excavated by the U. S. Engineering Department in connection with their channel lining project on Los Angeles River.

This arrangement for securing excavated material was mutually beneficial to the U. S. E. D. and the State since it provided a location readily accessible for the disposal of surplus



Bridge across Arroyo Seco Parkway on Orange Grove Avenue, Pasadena, is shown under construction flanked by off and on ramps.



Constructing and compacting fill for Arroyo Seco Parkway which closely parallels the concrete lined arroyo channel throughout this section.

material from the river bottom and at the same time has enabled the State to have constructed a considerable portion of the highway embankments between Avenue 22 and Pasadena Avenue at only the comparatively small cost of spreading and compacting the material.

The design and construction of this "Freeway" is a matter which is receiving the closest cooperation between the State, the cities of Los Angeles, South Pasadena and Pasadena, the various railroads involved, and Federal agencies. Only by such cooperation could the many intricate steps necessary for such a project be properly coordinated.

Plans for the "Parkway" include construction or partial reconstruction of sixteen street and railroad bridges crossing over the highway. These are at Avenue 26, Pasadena Avenue (in Los Angeles), Santa Fe and U. P. R. R. bridge near Pasadena Avenue, Avenue 43, Avenue 52, Hermon Avenue, Avenue 60, Marmion Way, all of which are in the city of Los Angeles, and Arroyo Drive, Grand Avenue, Orange Grove Avenue, Prospect Avenue, Meridian Avenue, Fremont Avenue, the U. P. and Santa Fe Bridge near Fremont Avenue and Fair Oaks Avenue which are in the city of South Pasadena.

The Santa Fe R. R. and Pasadena Avenue and Union Pacific R. R. crossings near the city limit of South Pasadena were already in place, the "Parkway" passing under these two structures. A bridge near the South Pasadena city limit will carry the "Parkway" across the Arroyo Seco Channel. In addition to the above listed bridges a viaduct has been constructed from the northerly end of the Figueroa tunnels across Los Angeles River, the S. P. R. R. and San Fernando Road over which "Parkway" traffic will be carried to connect with downtown Los Angeles via Figueroa Street.

At present the only section of the route open to traffic is from Glenarm Street in Pasadena to Fair Oaks Avenue in South Pasadena, a distance of 0.76 mile, which was completed January 4, 1939, at a cost of \$120,000.

The viaduct over Los Angeles River and adjacent railroads and streets was completed in 1937 at a cost of \$680,000. The Arroyo Drive and Grand Avenue bridges were constructed during 1938 under one contract at a total cost of \$111,000. The Avenue 60 bridge was completed March 3, 1939, at a cost of \$59,000. The 0.75 mile highway section from Hough Street in Los Angeles to Meri-

dian Street in South Pasadena including the Prospect Avenue and Orange Grove Avenue bridges, is under contract and will be completed late next fall. This section is estimated to cost \$177,000. Included also within these limits is the bridge crossing the Arroyo Seco Channel which will cost \$141,000. Bids for the Avenue 43 bridge were taken May 18, 1939, the low bid being about \$43,000.

WPA AND CITY COOPERATE

The next section which will be let to contract is from Avenue 50 to Avenue 58 including the Avenue 52 and Hermon Avenue bridges and grade separations. This will be followed by contracts for the Fremont Avenue Bridge and the highway section from Avenue 58 to Arroyo Drive.

In the meantime, the WPA project by the city of Los Angeles for lining the Arroyo Seco Channel and constructing storm drains, which must necessarily precede a considerable portion of the highway work, is being carried on. Plans for other bridges and highway sections of this route are being prepared and contracts will be let as soon as progress on the storm drains and Arroyo Seco Channel lining will permit.

Contracts completed or now in progress represent an outlay by the

State of \$1,331,000. The total estimated cost of the Arroyo Seco Parkway proper which includes highway and bridge work is \$3,745,000. This would indicate that approximately 36 per cent of the work has either been completed or let to contract. In addition to this the State will pay its proportionate share of the cost of materials for storm drains and lining the Arroyo Seco Channel.

EXTENSIVE LANDSCAPING

An outstanding example of the splendid cooperation which the park departments of the cities of Los Angeles, Pasadena and South Pasadena have given the Division of Highways is the landscaping of the recently completed highway section between Glenarm Street in Pasadena, and Fair Oaks Avenue in South Pasadena. Landscaping of this section has been planned by the park departments of the cities of Pasadena and South Pasadena in cooperation with the State highway landscape engineer and suitable plants and shrubs are being planted

by these departments from stock propagated in their own nurseries at no cost to the State.

It is too early to accurately predict the date when the "Parkway" will be opened to traffic for its full length. This will depend on a number of factors, the principal one of which is the completion of lining of the Arroyo Seco Channel between Avenue 36 and Avenue 22, which must be completed before this portion of the "Parkway" can be let to contract. From present indications, it is reasonable to expect the entire project will be completed toward the latter part of next biennium which ends June 30, 1941.

Supplementing the Arroyo Seco Parkway proper is the construction by the city of Los Angeles of Figueroa Street from the Figueroa Tunnels southerly to Sunset Boulevard including the College Street grade separation to facilitate the flow of traffic from the "Parkway" to the business district of Los Angeles.

Just southerly of Sunset Boulevard, Figueroa Street will pass under Temple Street on a grade separation now being constructed by the State. From the southerly limit of this contract at Diamond Street, preliminary plans are under consideration for improving Figueroa Street as far south as Second Street which will include a grade separation at First Street, this construction to be done by the State.

All of these improvements will form a comprehensive project for carrying traffic quickly and safely between downtown Los Angeles and the business district of Pasadena and intermediate communities. It is anticipated that the average driving time between the two cities will be reduced one half, which estimate is not based on excessive speeds but rather on the continuous flow of traffic without the interruptions of intersecting streets and railroads.

"Have you seen the new play I wrote about the couple who were always quarreling?"

"No, but I heard you and your wife rehearsing it."



Newly completed bridge on the Arroyo Seco Parkway at Grand Avenue. Sixteen street and railroad bridges will cross the parkway.



State Highway Route 5 through Oakland, Alameda County, widened and modernized with gas tax funds apportioned to city.

Cities Get \$15,606,223 of Gas Tax in Biennium Ending June 30, 1939

By L. V. CAMPBELL, Engineer of City and Cooperative Projects

DISTRIBUTION by the Department of Public Works through the Division of Highways of the April, 1939 quarterly apportionment of gas tax funds in the sum of \$1,856,936.20, for expenditure within incorporated limits of municipalities brings the total amount of these funds received by 285 California cities for expenditure upon State highways and streets of major importance to \$15,606,223.20 for the biennial period ending June 30 of this year.

The total apportionment combines $\frac{1}{4}$ cent of the gas tax or \$7,803,111.60 allocated under laws enacted by the Legislature in 1933 for expenditure upon designated State highway routes within incorporated cities, with an equal amount, or an additional $\frac{1}{4}$ cent, subsequently allocated by the Legislature in 1935 for expenditure upon streets of major importance other than State highways. In those cities where there are no State highways, the total amount may be expended upon streets of major importance.

The above amount includes \$224.92 apportioned to the city of Hornitos which, although an incorporated city,

does not have any functioning city officials and is therefore unable to comply with the requirements of the Streets and Highways Code for the expenditure of its share of the gas tax.

The apportionment is made to the various cities upon a population basis. The population is that determined by the Federal census of 1930, which is increased by multiplying by three the number of registered electors residing in any unincorporated territory annexed to a city subsequent to the 1930 Federal census. Likewise, the population of any city incorporated since the 1930 census is determined by multiplying the number of registered electors residing therein by three.

Cities incorporated during the past two years, or since April 1, 1937, are: Palm Springs, Pismo Beach, Shafter, and Tulalake.

Direct payment of the money to the cities by the Division of Highways is made in quarterly apportionments, upon the warrant of budgets of proposed expenditures submitted by the cities annually to the Department for approval.

The law is quite explicit on the latter point and operates to restrain the Department from paying money to a city until a budget has been submitted and approved.

An important qualification of such budgets is the expenditure upon streets commanding prominence as major traffic arterials. This condition precludes indiscriminate expenditures upon streets which are restrictive of general traffic service. Other conditions of the law require the proposals to be sound both economically and in engineering judgment, with a full appreciation of traffic demands, under penalty of disapproval by the Department.

Under section 203 of the code which provides the allocation for State highways, the Division of Highways is obliged to assure the expenditure of funds apportioned under this section for the fullest benefit of State highway routes, with the further discretionary privilege of delegating the obligation to cities competently equipped to conduct such expenditures.

The apportionment to cities by State highway districts is as follows:

Gas Tax Apportionments to Cities for Expenditure Upon Streets of Major Importance and State Highways Within Municipalities During Biennium

District I

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
Del Norte County			
Crescent City.....	\$1,559.21	\$1,560.93	\$3,120.14
Humboldt County			
Arcata	\$1,549.25	\$1,550.94	\$3,100.19
Blue Lake	503.11	503.67	1,006.78
Eureka	14,279.53	14,295.16	28,574.69
Ferndale	805.90	806.78	1,612.68
Fortuna	1,123.18	1,124.41	2,247.59
Trinidad	97.01	97.09	194.10
Totals	\$18,357.98	\$18,378.05	\$36,736.03
Lake County			
Lakeport	\$1,194.80	\$1,196.10	\$2,390.90
Mendocino County			
Fort Bragg.....	\$2,739.51	\$2,742.50	\$5,482.01
Point Arena	349.02	349.39	698.41
Ukiah	2,831.97	2,835.07	5,667.04
Willits	1,290.89	1,292.30	2,583.19
Totals	\$7,211.39	\$7,219.26	\$14,430.65
Totals District I.....	\$28,323.38	\$28,354.34	\$56,677.72

District II

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
Lassen County			
Susanville	\$1,231.06	\$1,232.40	\$2,463.46
Modoc County			
Alturas	\$2,119.45	\$2,121.77	\$4,241.22
Plumas County			
Shasta County			
Redding	\$3,796.51	\$3,800.67	\$7,597.18
Siskiyou County			
Dorris	\$690.77	\$691.52	\$1,382.29
Dunsmuir	2,366.01	2,368.61	4,734.62
Etna	343.57	343.95	687.52
Fort Jones	273.78	274.07	547.85
Montague	459.61	460.11	919.72
Mt. Shasta	938.93	964.69	1,903.62
Tulelake	271.96	272.25	544.21
Yreka	1,995.25	1,997.43	3,992.68
Totals	\$7,339.88	\$7,372.63	\$14,712.51
Tehama County			
Corning	\$1,248.28	\$1,249.64	\$2,497.92
Red Bluff.....	3,188.24	3,191.73	6,379.97
Tehama	172.24	172.43	344.67
Totals	\$4,608.76	\$4,613.80	\$9,222.56
Trinity County			
Totals District II.....	\$19,095.66	\$19,141.27	\$38,236.93

District III

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
Butte County			
Biggs	\$419.72	\$420.18	\$839.90
Chico	7,216.81	7,224.72	14,441.53
Gridley	1,759.57	1,761.48	3,521.05
Oroville	3,352.33	3,355.98	6,708.31
Totals	\$12,748.43	\$12,762.36	\$25,510.79
Colusa County			
Colusa	\$1,918.21	\$1,920.29	\$3,838.50
Williams	787.76	788.63	1,576.39
Totals	\$2,705.97	\$2,708.92	\$5,414.89
El Dorado County			
Placerville	\$2,145.74	\$2,148.09	\$4,293.83
Glenn County			
Orland	\$1,083.30	\$1,084.48	\$2,167.78
Willows	1,834.79	1,836.81	3,671.60
Totals	\$2,918.09	\$2,921.29	\$5,839.38
Nevada County			
Grass Valley	\$3,460.19	\$3,463.99	\$6,924.18
Nevada City.....	1,542.00	1,543.67	3,085.67
Totals	\$5,002.19	\$5,007.66	\$10,009.85
Placer County			
Auburn	\$2,412.27	\$2,414.90	\$4,827.17
Colfax	826.75	827.65	1,654.40
Lincoln	1,898.26	1,900.34	3,798.60
Rocklin	656.31	657.03	1,313.34
Roseville	5,824.39	5,830.77	11,655.16
Totals	\$11,617.98	\$11,630.69	\$23,248.67
Sacramento County			
North Sacramento	\$1,900.98	\$2,022.70	\$3,923.68
Sacramento	84,986.46	85,079.35	170,065.81
Totals	\$86,887.44	\$87,102.05	\$173,989.49
Sierra County			
Loyalton	\$758.76	\$759.58	\$1,518.34
Sutter County			
Yuba City.....	\$3,268.01	\$3,271.59	\$6,539.60
Yolo County			
Davis	\$1,126.81	\$1,128.03	\$2,254.84
Winters	812.25	813.13	1,625.38
Woodland	5,052.46	5,062.12	10,114.58
Totals	\$6,991.52	\$7,003.28	\$13,994.80
Yuba County			
Marysville	\$5,224.28	\$5,229.99	\$10,454.27
Wheatland	434.23	434.70	868.93
Totals	\$5,658.51	\$5,664.69	\$11,323.20
Totals District III.....	\$140,702.64	\$140,980.20	\$281,682.84

Gas Tax Apportionments to Cities

District IV

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
Alameda County			
Alameda	\$31,758.20	\$31,792.92	\$63,551.12
Albany	7,768.00	7,776.47	15,544.47
Berkeley	74,433.63	74,515.00	148,948.63
Emeryville	2,117.64	2,119.95	4,237.59
Hayward	5,013.07	5,018.54	10,031.61
Livermore	2,827.43	2,830.53	5,657.96
Oakland	257,509.42	257,790.92	515,300.34
Piedmont	8,460.57	8,469.83	16,930.40
Pleasanton	1,121.37	1,122.59	2,243.96
San Leandro	10,384.21	10,395.57	20,779.78
Totals	\$401,393.54	\$401,832.32	\$803,225.86
Contra Costa County			
Antioch	\$4,086.60	\$4,396.51	\$8,483.11
Concord	1,019.84	1,020.96	2,040.80
El Cerrito	3,508.24	3,512.07	7,020.31
Hercules	355.36	355.74	711.10
Martinez	6,670.85	7,192.02	13,862.87
Pinole	707.99	708.77	1,416.76
Pittsburg	8,711.67	8,721.21	17,432.88
Richmond	18,301.78	18,321.79	36,623.57
Walnut Creek	919.21	920.22	1,839.43
Totals	\$44,281.54	\$45,149.29	\$89,430.83
Marin County			
Belvedere	\$453.27	\$453.75	\$907.02
Corte Madera	930.99	932.02	1,863.01
Fairfax	2,651.57	2,654.48	5,306.05
Larkspur	1,125.00	1,126.22	2,251.22
Mill Valley	3,774.76	3,778.88	7,553.64
Ross	1,228.34	1,229.68	2,458.02
San Anselmo	4,215.33	4,219.95	8,435.28
San Rafael	7,272.12	7,280.07	14,552.19
Sausalito	3,324.21	3,327.85	6,652.06
Totals	\$24,975.59	\$25,002.90	\$49,978.49
Napa County			
Calistoga	\$906.51	\$907.52	\$1,814.03
Napa	5,835.28	5,841.66	11,676.94
St. Helena	1,434.13	1,435.69	2,869.82
Totals	\$8,175.92	\$8,184.87	\$16,360.79
San Francisco County			
San Francisco	\$575,092.25	\$575,720.91	\$1,150,813.16
San Mateo County			
Atherton	\$1,200.23	\$1,201.54	\$2,401.77
Bay Shore	1,041.60	1,042.73	2,084.33
Belmont	905.61	906.61	1,812.22
Burlingame	12,029.54	12,042.69	24,072.23
Daly City	7,646.51	7,654.88	15,301.39
Hillsborough	1,714.24	1,716.10	3,430.34
Lawndale	334.50	334.88	669.38
Menlo Park	2,043.32	2,045.53	4,088.85
Redwood City	8,124.25	8,133.13	16,257.38
San Bruno	3,272.54	3,276.13	6,548.67
San Carlos	1,026.18	1,027.31	2,053.49
San Mateo	12,198.17	12,211.50	24,409.67
South San Francisco	5,614.09	5,620.23	11,234.32
Totals	\$57,150.78	\$57,213.26	\$114,364.04

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
Santa Clara County			
Alviso	\$345.37	\$345.75	\$691.12
Gilroy	3,174.63	3,178.12	6,352.75
Los Gatos	2,871.87	2,874.99	5,746.86
Morgan Hill	823.12	824.03	1,647.15
Mountain View	2,998.78	3,002.06	6,000.84
Palo Alto	12,541.73	12,558.68	25,100.41
San Jose	56,224.33	56,285.79	112,510.12
Santa Clara	5,712.91	5,719.15	11,432.06
Sunnyvale	2,804.79	2,807.84	5,612.63
Totals	\$87,497.53	\$87,596.41	\$175,093.94
Santa Cruz County			
Santa Cruz	\$13,049.40	\$13,063.66	\$26,113.06
Watsonville	7,833.26	7,841.81	15,675.07
Totals	\$20,882.66	\$20,905.47	\$41,788.13
Sonoma County			
Cloverdale	\$688.05	\$688.80	\$1,376.85
Healdsburg	2,081.36	2,083.64	4,165.00
Petaluma	7,474.28	7,482.44	14,956.72
Santa Rosa	9,641.78	9,709.34	19,351.12
Sebastopol	1,597.30	1,599.04	3,196.34
Sonoma	888.39	889.37	1,777.76
Totals	\$22,371.16	\$22,452.63	\$44,823.79
Totals District IV	\$1,241,820.97	\$1,244,058.06	\$2,485,879.03

District V

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
Monterey County			
Carmel	\$2,048.73	\$2,050.99	\$4,099.72
King City	1,344.38	1,345.85	2,690.23
Monterey	8,286.52	8,295.57	16,582.09
Pacific Grove	5,038.45	5,043.95	10,082.40
Salinas	9,485.84	9,496.21	18,982.05
Soledad	538.49	539.06	1,077.55
Totals	\$26,742.41	\$26,771.63	\$53,514.04
San Benito County			
Hollister	\$3,405.80	\$3,409.53	\$6,815.33
San Juan	699.84	700.61	1,400.45
Totals	\$4,105.64	\$4,110.14	\$8,215.78
San Luis Obispo County			
Arroyo Grande	\$808.60	\$809.50	\$1,618.10
Paso Robles	2,332.48	2,335.04	4,667.52
Pismo Beach	0.00	338.87	338.87
San Luis Obispo	7,502.38	7,510.58	15,012.96
Totals	\$10,643.46	\$10,993.99	\$21,637.45
Santa Barbara County			
Lompoc	\$2,579.06	\$2,581.87	\$5,160.93
Santa Barbara	30,470.93	30,504.24	60,975.17
Santa Maria	6,397.33	6,404.32	12,801.65
Totals	\$39,447.32	\$39,490.43	\$78,937.75
Totals District V	\$80,938.83	\$81,366.19	\$162,305.02

District VI

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
Fresno County			
Coalinga	\$2,584.51	\$2,587.33	\$5,171.84
Clovis	1,192.98	1,194.28	2,387.26
Firebaugh	458.70	459.20	917.90
Fowler	1,061.55	1,062.70	2,124.25
Fresno	47,933.27	48,406.95	96,340.22
Kingsburg	1,198.43	1,199.73	2,398.16
Parlier	511.28	511.83	1,023.11
Reedley	2,346.99	2,349.56	4,696.55
Sanger	2,689.64	2,692.59	5,382.23
San Joaquin	147.76	147.93	295.69
Selma	2,762.16	2,765.19	5,527.35
Totals	\$62,887.27	\$63,377.29	\$126,264.56
Kern County			
Bakersfield	\$23,583.17	\$23,608.96	\$47,192.13
Delano	2,385.97	2,388.57	4,774.54
Maricopa	970.89	971.95	1,942.84
Shafter	266.96	1,146.18	1,413.14
Taft	3,120.26	3,123.66	6,243.92
Tehachapi	667.19	667.94	1,335.13
Totals	\$30,994.44	\$31,907.26	\$62,901.70
Kings County			
Corcoran	\$1,602.74	\$1,604.49	\$3,207.23
Hanford	6,371.04	6,378.00	12,749.04
Lemoore	1,268.22	1,269.61	2,537.83
Totals	\$9,242.00	\$9,252.10	\$18,494.10
Madera County			
Chowchilla	\$767.82	\$768.67	\$1,536.49
Madera	4,228.92	4,233.55	8,462.47
Totals	\$4,996.74	\$5,002.22	\$9,998.96
Tulare County			
Dinuba	\$2,690.56	\$2,693.51	\$5,384.07
Exeter	2,434.02	2,436.67	4,870.69
Lindsay	3,515.49	3,519.34	7,034.83
Porterville	4,807.29	4,812.53	9,619.82
Tulare	5,626.77	5,632.93	11,259.70
Visalia	6,584.08	6,591.27	13,175.35
Totals	\$25,658.21	\$25,686.25	\$51,344.46
Totals District VI	\$133,778.66	\$135,225.12	\$269,003.78

District VII

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
Los Angeles County			
Alhambra	\$26,717.03	\$26,746.23	\$53,463.26
Arcadia	4,728.41	4,733.60	9,462.01
Avalon	1,719.67	1,721.54	3,441.21
Azusa	4,358.56	4,363.32	8,721.88
Bell	7,147.02	7,154.84	14,301.86
Beverly Hills	15,799.78	15,817.05	31,616.83
Burbank	15,104.47	15,120.98	30,225.45
Claremont	2,464.84	2,467.53	4,932.37
Compton	11,346.03	11,358.43	22,704.46
Covina	2,514.69	2,522.87	5,037.56
Culver City	5,139.08	5,144.69	10,283.77
El Monte	3,153.79	3,157.23	6,311.02
El Segundo	3,175.54	3,179.02	6,354.56
Gardena	6,385.54	6,392.52	12,778.06
Glendale	56,871.57	56,933.74	113,805.31
Glendora	2,502.91	2,505.65	5,008.56
Hawthorne	5,979.42	5,985.95	11,965.37
Hermosa Beach	4,347.68	4,352.44	8,700.12

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
Los Angeles County—Continued			
Huntington Park	\$22,292.29	\$22,316.65	\$44,608.94
Inglewood	19,418.61	19,439.85	38,858.46
La Verne	2,592.65	2,595.50	5,188.15
Long Beach	129,231.99	129,394.13	258,626.12
Los Angeles	1,124,608.81	1,125,838.17	2,250,446.98
Lynwood	6,638.45	6,645.72	13,284.17
Manhattan Beach	1,714.24	1,716.10	3,430.34
Maywood	6,158.91	6,165.65	12,324.56
Monrovia	9,872.03	9,882.82	19,754.85
Montebello	4,984.06	4,989.51	9,973.57
Monterey Park	5,807.19	5,813.52	11,620.71
Pasadena	69,223.85	69,299.52	138,523.37
Pomona	18,859.29	18,879.91	37,739.20
Redondo Beach	8,473.27	8,482.53	16,955.80
San Fernando	6,859.65	6,867.15	13,726.80
San Gabriel	6,616.70	6,623.94	13,240.64
San Marino	3,381.32	3,385.02	6,766.34
Santa Monica	33,673.68	33,710.48	67,384.16
Sierra Madre	3,218.16	3,221.66	6,439.82
Signal Hill	2,657.93	2,660.84	5,318.77
South Gate	17,796.85	17,816.29	35,613.14
South Pasadena	12,446.55	12,460.16	24,906.71
Torrance	8,008.20	8,016.97	16,025.17
Vernon	1,150.38	1,151.64	2,302.02
West Covina	868.11	904.81	1,772.92
Whittier	13,458.23	13,472.93	26,931.16
Totals	\$1,719,467.43	\$1,721,409.10	\$3,440,876.53
Orange County			
Anaheim	\$9,983.53	\$9,994.44	\$19,977.97
Brea	2,207.38	2,209.79	4,417.17
Fullerton	9,844.84	9,855.59	19,700.43
Huntington Beach	3,345.08	3,348.73	6,693.81
Laguna Beach	1,795.82	1,797.79	3,593.61
La Habra	2,060.53	2,062.77	4,123.30
Newport Beach	1,997.06	1,999.25	3,996.31
Orange	7,312.01	7,320.00	14,632.01
Placentia	1,455.87	1,457.47	2,913.34
San Clemente	604.65	605.32	1,209.97
Santa Ana	27,487.56	27,517.61	55,005.17
Seal Beach	1,047.94	1,049.09	2,097.03
Tustin	839.43	840.36	1,679.79
Totals	\$69,981.70	\$70,058.21	\$140,039.91
Ventura County			
Fillmore	\$2,622.56	\$2,625.43	\$5,247.99
Ojai	1,330.77	1,332.24	2,663.01
Oxnard	5,697.49	5,703.72	11,401.21
Santa Paula	6,755.41	6,762.78	13,518.19
Ventura	10,518.39	10,529.88	21,048.27
Totals	\$26,924.62	\$26,954.05	\$53,878.67
Totals District VII	\$1,816,373.75	\$1,818,421.36	\$3,634,795.11

District VIII

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
Riverside County			
Banning	\$2,508.35	\$2,511.08	\$5,019.43
Beaumont	1,207.49	1,208.80	2,416.29
Corona	6,361.97	6,368.92	12,730.89
Elsinore	1,223.80	1,225.15	2,448.95
Hemet	2,026.07	2,028.30	4,054.37
Palm Springs	0.00	2,316.89	2,316.89
Perris	691.68	692.43	1,384.11
Riverside	26,920.09	26,949.51	53,869.60
San Jacinto	1,220.18	1,221.52	2,441.70
Totals	\$42,159.63	\$44,522.60	\$86,682.23

(Continued on page 28)

"Movie" Camera Records Traffic Violations Through the Windshield

By A. I. Rivett, Assistant Safety Engineer



Riding double stripe over crest of hill.



Passing four cars in face of oncoming traffic.



Passing truck to right on a curve.

"Oh, wad some power the giftie gi'e us
To see oursel's as ithers see us!"

Robert Burns

THE average motorist does not intend to be a lawbreaker. Nor, frequently, does he realize that he is, as he rolls merrily along, using what he deems to be due caution.

Cold, bare facts, however, indicate that improper turning and passing, violating the right of way, following too closely, excessive speed and loss of control were among the major causes of accidents during the past year.

Such accidents are the direct result of carelessness, chance-taking, absent-mindedness, recklessness—a failure on the part of the motorist to actually use due caution.

The problem of bringing a realization of these facts to the motorist is not one of engineering nor of enforcement, but one of individualized personal education. Engineering and enforcement agencies, however, are definitely responsible for the furtherance of traffic education.

The Safety Department of the Division of Highways in its study of traffic conditions and the presentation

of its findings to the public throughout California is making use of the motion picture camera. A modern philosopher has said, "One picture is worth one thousand words." In traffic education, if the picture be unposed, an actual photograph of a supposedly normal and average motorist or pedestrian, depicting his misconduct, it is worth two thousand words.

The Safety Department of the Division of Highways is using a 16 mm movie camera inconspicuously mounted behind the windshield of an automobile. Actions of motorists or pedestrians on the highway ahead are quickly and easily recorded by the pressure of a button.

Immediately there becomes available a visual and sometimes unpleasant story for presentation to public groups. A story which paints in permanent black and white the failure of someone to observe traffic stop-signs or signals and warning signs; the failure to practice highway courtesies, to give correct hand signals; the failure to reduce speed at dangerous points, to keep in the proper traffic lane and many other traffic infractions.

Here is a lasting record of chance-

taking and reckless driving—attempts to pass on a blind curve at the crest of grade, passing over double stripes, driving to the right of slower moving vehicles, cutting in, and passing with insufficient room.

And, in the pictured story can be found samples of absentmindedness—turning without signaling, stepping out of the left side of the car without looking back, parking too close to the pavement while making repairs, turning from watching the road ahead to talk or to observe the side scenery.

A looking-glass is a most harsh personal critic—a motion picture film of actual highway misconduct likewise reflects forcible criticisms.

It should be noted that these pictures are being taken for educational information and engineering study, and not for enforcement purposes. It is believed that the motorist, often unaware that he is breaking a safe driving habit, will appreciate being reminded of his violations that he might voluntarily correct his driving errors and cooperate with other drivers to make the highway safe for motorists and pedestrians.

Traffic engineers have long known that traffic problems can be reduced or improved by three methods, dif-

ferent but associated. First, the engineering approach, making changes in the physical condition so as to make more easy, correct, safe and expeditious practices. Second, enforcement policies wherein the individual's behavior is kept in right channels by direct social pressure and compulsion. Third, an educational conviction, changing the individual's attitude by precept and instruction so as to make safe practices common and instinctive.

It is quite evident that the first method of approach, engineering, the most effective and permanent, is the most costly. Enforcement, though always necessary, is primarily directed to the nonconformist and the wilful misbehaviorist. Education, while the most ethical and desirable, and perhaps the most indirect for some individuals and classes, can be the most effective means of creating good traffic conduct if the "whys" and "wherefores" are understood.

It is not fear of the law, the dire consequences of breaking the rule of the road, which keeps us from breaking traffic regulations, though this point often has been stressed. The important thing is not that we should fear the law but that we should recognize the value and importance of the rule and appreciate its functions. Action pictures of road conduct quickly bring personal conviction. Traffic education pays.

The Safety Department of the Division of Highways in its study of highway traffic places an equal value

Are You a Hypocrite?

The average motorist is an unconscious hypocrite. That's a strong characterization—but a little impersonal analysis will substantiate it.

How often have you roundly criticized some driver for an offense which you commit periodically yourself? How often have you taken comfort in the thought that accidents are caused by some reckless breed of motorists with whom you have nothing in common, thus dodging the fact that only pure fool's luck has saved you from a crash on a dozen occasions?

Who, for example, doesn't sometimes pass a car when the stretch of empty road that can be seen is too short for safety? Who doesn't occasionally succumb to the lure of excessive speed—even though he has little or nothing to do when his destination is reached?

We'll go a good way toward reducing accidents when the average driver begins asking himself such questions and returning honest answers. Accident prevention, so far as it concerns the human element, is a personal, individual matter—and each individual has to really want to drive safely at all times before he can analyze his driving errors and correct them.—Woodland Democrat, Woodland, California.

upon traffic pictures as a means of engineering study. Motion pictures definitely record driver-action in relation to engineering facilities provided in the highways—the respect for

stripes, lanes, guard-rails, curve construction, signs and signals.

Similar data to that obtained by aerial motion pictures (described in the May, 1939, issue of CALIFORNIA HIGHWAYS AND PUBLIC WORKS) is obtained by behind-the-windshield pictures. Using an automobile-mounted movie camera, the United States Bureau of Public Roads has made an extensive study of traffic habits of motorists. Much of strictly engineering value is obtained from movie records of traffic observed.

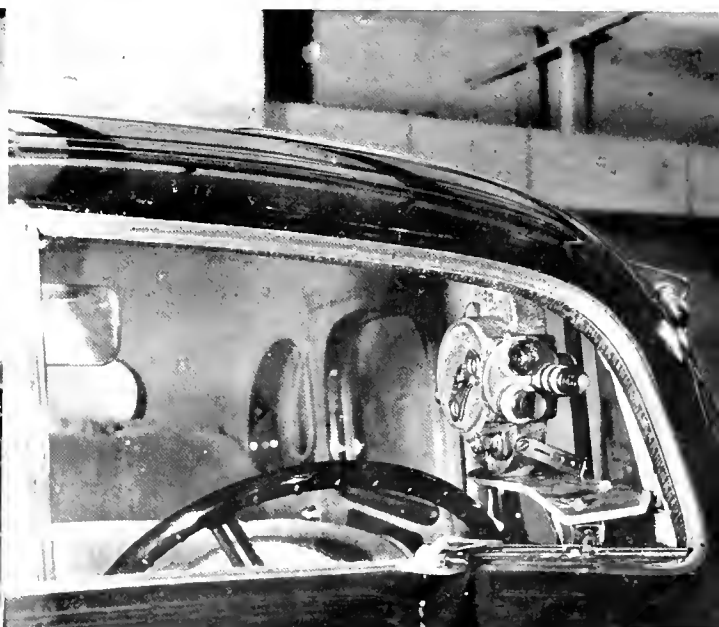
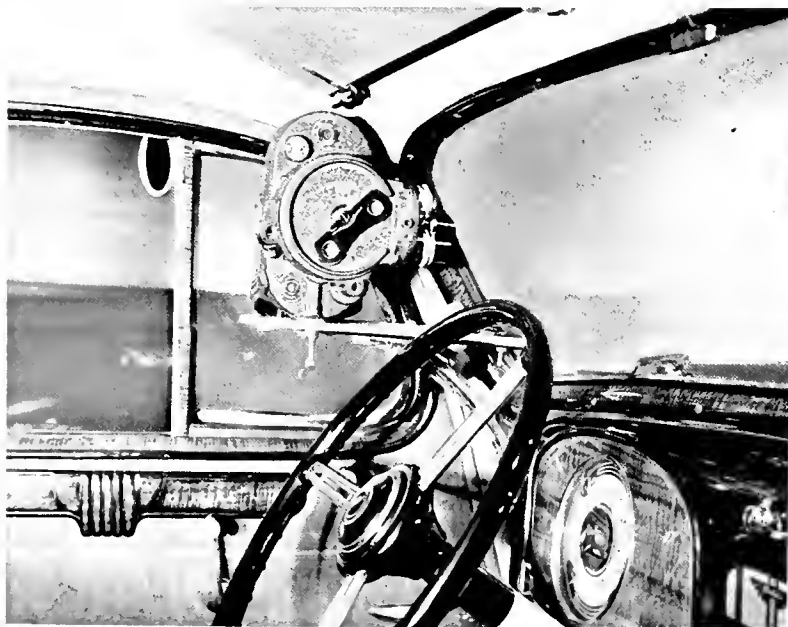
The great educational value of presenting imposed pictures of driver-habits has been overlooked in the past. Positive and constructive value is being obtained from the presentation of the visual story to the public of the public's driving-habits. Every picture tells a story.

CITIES WIN SAFETY LAURELS

Six California cities won citations from the California Safety Council for their accomplishment in traffic accident prevention, at its annual awards luncheon in Los Angeles. They are: Los Angeles, Berkeley, Ventura, Piedmont, Redding, Ross.

The William May Garland Safety Trophy for the most outstanding traffic record in decreasing fatalities was presented to San Francisco, which scored a 24 per cent decrease in fatal accidents during 1938, according to Dr. Floyd Ruch, U. S. C. psychologist, who tabulated returns.

Honorable mention for "conspicuous achievement in accomplishing substantial traffic accident reduction during the year 1938" went to San Diego, Alameda, El Centro, Chico, and Morgan Hill. The latter were runner-ups for first place in their population classifications.



"Movie" camera operated by push button is set within easy reach of driver and is inconspicuous to approaching traffic.

Divided 4-Lane Highway Underpass Replaces Old Bottleneck Near Redding

By E. J. BASSETT, District Office Engineer

AN EXCELLENT example of the advancement in highway construction standards and safety design in a sixteen-year period is the recently completed grade separation project on State Highway 3 (U. S. 99) approximately one mile south of the city of Redding, where a narrow old subway beneath the Southern Pacific railroad tracks has been replaced by a modern four-lane divided highway underpass and approaches.

The old subway, built in 1923, had only a 15-foot roadway width, a restricted sight distance due to poor alignment, and an unenviable record of traffic accidents. Besides being a restrictive bottleneck through which traffic was forced to pass, the flooding of the subway during heavy storms presented additional hazards.

The new subway has 4160 feet of concrete-paved, four-lane approaches, with an 8-foot separation strip, partly a raised landscaped section protected with a curb. Each roadway is composed of two lanes, the inner one twelve feet wide and the outer one eleven feet in width.

For approximately 1500 feet adjacent to the subway structure the roadway is provided with a curb and a sidewalk 3.5 feet wide, while the remainder of the project has borders of asphaltic surfacing 3.5 feet wide and .21 of a foot thick.

The overhead railroad structure is a two-span, single-track, steel plate girder bridge.

The project involved the construction of a detour and temporary grade crossing of the railway, two county road approaches, the erection of a shoo-fly track and trestle for handling railroad traffic during removal and replacement of the old subway structure, the rearrangement of five gas and oil depots and spur track facilities and an elaborate system of drains and subdrains feeding into a 24-inch gravity outfall to prevent future flooding of the subway.

The necessary treatment of the subgrade consisted of the removal of deposits of black clay, in many in-

stances several feet below grade, and its replacement with stable material and the placing of imported subgrade material 0.5 of a foot thick over the entire width of roadway.

While the quantities of materials involved in the construction of this new and important grade separation were not unusual for a structure of this type, the following brief summary of the major quantities provides a conception of the size of the project.

The contract was awarded on the basis of unclassified roadway excavation and involved the movement of some 52,300 cubic yards of material. Removal of the black clay, which was not satisfactory for subgrade, necessitated the placing of more than 12,000 cubic yards of imported material to insure the desired stability.

Excavation for the structure required the moving of 6,600 cubic yards of earth.

The Portland cement concrete pavement placed through the subway and on the approaches involved preparation of 14,350 square yards of subgrade on which the 2,863 cubic yards of concrete was placed. The structure itself required 1,469 cubic yards of concrete and an additional 486 cubic yards was used for curbs and sidewalks.

Approximately 160,000 pounds of reinforcing steel was placed in the concrete of the structure and the pavement. The structural steel, cast steel, and wrought iron plate used in the girder construction which carries the railroad tracks over the highway amounted to more than 448,000 pounds.

Construction of drainage facilities necessitated the placing of 2,312 linear feet of 18-inch and 24-inch reinforced concrete pipe, 362 linear feet of various sizes of corrugated



Old subway on U. S. 99 near Redding built in 1923 had 15-foot curved roadway.



Two views of recently completed modern, 4-lane subway with 8-foot division strip on U. S. 99 near Redding.

metal pipe and 2,987 linear feet of perforated metal pipe subdrains.

The completion of the project was timely in view of the rapid increase in the volume of traffic in this area occasioned by the heavy construction program of the U. S. Bureau of Reclamation involving not only Shasta Dam itself but 30 miles of new railroad and 16 miles of highway.

Traffic counts indicate that the increase approximated 58 per cent be-

tween July, 1937, and October, 1938, with the peak of the heavy traffic yet to come. The project was financed from federal grade separation funds and State highway funds. The anticipated reimbursement by the federal government, including preliminary and construction engineering and construction costs to the railroad in which the State participated, total \$219,727. Additional engineering, construction and costs of furnished material to be

borne by the State amounts to \$10,600, making a grand total cost of \$230,327.

The project was constructed by N. M. Ball and Sons under a single contract and was under the direction of P. R. Watson, Resident Engineer of the Bridge Department of the Division of Highways. The grading and paving was supervised by M. Fredericksen, Resident Engineer for District II of Division of Highways.



Bombs Do Explode If Hit by Bullets

As a result of over zealotness on the part of a Plumas County constable in what he believed to be the performance of his duty, the Division of Water Resources is minus one recorder used to determine the height of water and stream flow on the Middle Fork of the Feather River.

This particular recorder was installed on a float wedged against a concrete pier of a Western Pacific Railway bridge. A passing trout fisherman, hearing the clock which registers stream flow, thought it was a bomb and excitedly telephoned the constable, who rushed to the scene with a high powered rifle and blasted the recorder to bits with sixteen bullets.

What puzzles Division of Water Resources officials is why the constable didn't pause to consider that if the recorder was an infernal machine set to go off by a time clock it would explode more readily if steel-jacketed bullets were fired into it.

From Reader in Alaska

Territorial Department of Health
Juneau, Alaska

Editor, California Highways and
Public Works,
Sacramento, California.

Dear Sir:

This is to notify you as to my recent change of address from eastern Washington in order to facilitate receipt of California Highways and Public Works.

I have been an ardent reader of the magazine for several years and look forward to each issue. Inasmuch as I was at one time a member of the Division, under E. E. Wallace in District XI, the many problems discussed and their solutions are of personal interest. Each clear pictorial evidence of a reduced grade, a new underpass, or a reduction of curves presented in your publication demonstrates to me the elimination of a familiar highway hazard. In short, the magazine is great and I sincerely appreciate receiving it.

May I extend my wishes for the continued success of California Highways and Public Works and of the men and women it represents.

Yours very truly,

KAARLO W. NASI,
Territorial Public Health Engineer.

New Lompoc Bridge Over Santa Ynez River Opened

WITH representatives of the Division of Highways, officials from three counties and civic leaders participating, the city of Lompoc on May 1 staged a celebration to dedicate the new Robinson crossing bridge over the Santa Ynez River.

The new structure replaces an old iron and wooden bridge erected 54 years ago and eliminates a hazardous horseshoe curve on the Lompoc-Buellton highway. It is 447 feet in length and consists of five 80-foot spans, with two 21-foot spans at either end. Long, straight approaches do away with sharp curves that have slowed up traffic materially in the past. Its design has some novel features providing additional rigidity for the structure and economy in foundation construction.

The three-quarters of a mile of new approaches which were constructed to give access to the new bridge present a marked contrast to those which led to the former structure. The old approaches containing eleven curves with radii as short as 150 feet and sight distances as low as 500 feet have been replaced by approaches having only two curves, one of 1500 feet radius and the other of 10,000 feet and affording unlimited sight distance.

Robinson bridge was officially opened by F. W. Panhorst, Bridge Engineer of the Division of Highways, under whose supervision the structure was built.

In his dedicatory address, Mr. Panhorst called attention to the serious bridge problems confronting the Division of Highways. He said there are 12,000 bridges on California highways and that 320 of them are incapable of bearing legal loads and should be immediately replaced. He declared that it would require \$70,000,000 for bridge construction imperatively needed and that \$100,000,000 would have to be expended to bring the highways of the State up to standards which would enable them to carry present day traffic, which totals twenty-two billion vehicle miles per year or fifty-five million vehicle miles a day.

In the same vein, District Highway Engineer Lester H. Gibson of San Luis Obispo declared that funds now available for highway construction and maintenance are entirely inadequate.

Following the dedicatory ceremonies, visiting officials and guests of the Lompoc Chamber of Commerce, which arranged the celebration, were taken on a sightseeing tour which included the ancient Mission La Purisima. Later a barbecue was held in the Veterans Memorial Building in Lompoc with President M. V. Duncan of the chamber of commerce presiding.

Speakers at the dedication included Supervisor Ronald M. Adam, County Surveyor Owen O'Neill, who has constructed 153 bridges in Santa Barbara County during his twenty-five years tenure of office; W. T. Hobbs, chairman of the reception committee; C. L. Preisker of Santa Maria, chairman of the board of supervisors, and Alexander McLean, pioneer resident, who gave a history of the old bridge.

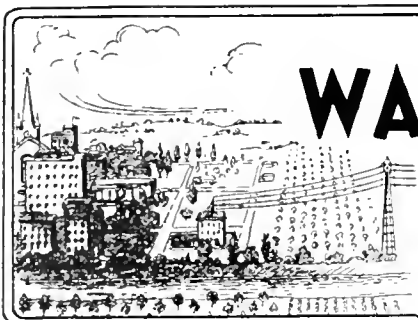
Highway Exhibit Arouses Interest

Cuts made from photographs of the diorama on exhibition by the Division of Highways on Treasure Island, which graphically depicts the highways of Yesterday, Today and Tomorrow, and which appeared in the April issue of CALIFORNIA HIGHWAYS AND PUBLIC WORKS, have attracted widespread attention.

Editors of various publications have asked to borrow the cuts for reproduction. The Tennessee Road Builder, published in Nashville, Tennessee; the South Dakota Hiway Magazine, published in Sioux Falls, South Dakota, and The California Highway Patrolman, the Architect and Engineer and Sunset Magazine, published in San Francisco, are among publications which have requested the loan of either the cuts or photographs. Newspapers throughout the State have been equally interested.



At top, profile view of new Santa Ynez River bridge near Lompoc on State Highway 149 in Santa Barbara County which was officially dedicated May 1. Below at left, new approach road that eliminates numerous sharp curves. At right, old steel and wood bridge built 54 years ago.



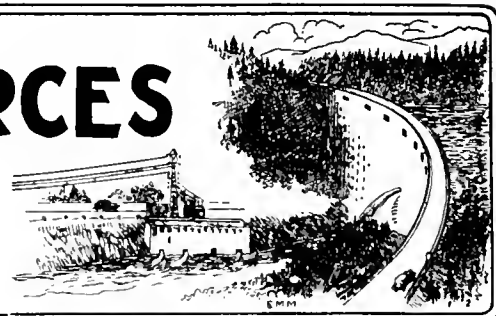
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

MAY, 1939

EDWARD HYATT, State Engineer



ENGINEERING studies for negotiations in connection with the acquisition of water rights and rights of way for the Central Valley Project have been continued during the month. Under an agreement between the Water Project Authority of the State of California and the United States of America, the Division of Water Resources, representing the Authority, is to continue field work in addition to that previously performed by the Division, the compilation of data previously obtained and the preparation of reports containing these data, and negotiations with public utility companies for power and communication line relocations.

Under this agreement, the activities during the month included field surveys for the preparation of topographic maps of lands adjacent to the San Joaquin River between Friant and Gravelly Ford and the preparation of reports on the acquisition of and plan of exchange for waters of the San Joaquin River. The work has also included the preparation of folios of maps showing character of water rights and sources of water supply for lands, soil and land classifications, and the rating of soils.

In addition to the work being performed under the contract with the United States, studies are proceeding with regard to the disposal and distribution of power which will be available from the Shasta power plant of the project, including the programming of additional facilities to provide for the absorption thereof in the market of northern and central California. In this connection, the Division of Water Resources prepared a brief on behalf of the Water Project Authority which was transmitted to the Federal Power Commission, requesting the commission to deny the application of the Pacific Gas & Electric Company for a preliminary permit

for hydro-electric power plants on the north fork of the Feather River.

IRRIGATION DISTRICTS

Clearwater-Hynes and Gibson Park County water districts submitted applications for approval of consolidation procedure. An investigation and report on the proposal will be made with recommendations as to equitable apportionment of the present outstanding indebtedness to lands of the respective districts.

Richvale Irrigation District plans for acquiring additional water rights and facilities from the Sutter Butte Canal Company were advanced during the month by the voting of a new bond issue in the amount of \$160,000. The project was favorably reported on by the State Engineer and approved by the Districts Securities and State Railroad Commissions.

Coreoran Irrigation District's refinancing plan was declared just and equitable to all creditors in a decision of the U. S. District Court at Fresno. The district has an outstanding bonded indebtedness of \$733,000 which is being refinanced at the rate of 75 cents on the dollar through a loan from the Reconstruction Finance Corporation.

DISTRICTS SECURITIES COMMISSION

At a regular meeting of the California Districts Securities Commission in San Francisco on May 12, 1939, Banta-Carbena Irrigation District petition was granted for approval of an expenditure of \$12,307.84 from district funds for the purchase and installation of electrical equipment on the pumping system.

West Side Irrigation District requested approval of a refunding bond issue in the amount of \$286,500 for certification by the State Controller. Refunding bonds were issued to take up outstanding bonds of \$510,500 and warrants in the sum of \$56,331 on the basis of approximately 50 cents on the dollar. The owners of more than 90 per cent of the bonds and warrants agreed to accept the offer, and the U. S. District Court confirmed the plan. The request was granted.

Richvale Irrigation District's application was granted for approval of a bond issue of \$160,000 for repayment of a loan from the Reconstruction Finance Corporation. Proceeds will be used to purchase a share of the water rights and irrigation facilities of the Sutter Butte Canal Company and for certain rehabilitation work.

Alpaugh Irrigation District was granted validation of a refunding issue of \$54,000 for certification by the State Controller. The bonds are to cover the balance of \$54,520 due on Reconstruction Finance Corporation loan.

SUPERVISION OF DAMS

Application was filed for approval of plans and specifications for construction of Middle Fork Dam in Calaveras County, owned by the Calaveras Public Utility District.

Applications were filed and approved for alteration of Stanislaus Forebay Dam and repair of Sand Bar Dam in Tuolumne County, both owned by the Pacific Gas and Electric Company.

Application was filed for approval of plans for alteration of the Hog Flat Dam in Lassen County, owned by the Lassen Irrigation Company.

WATER RIGHTS

Supervision of Appropriation of Water

Thirty-one applications to appropriate water were received during April; 15 were denied, none was approved and rights were confirmed for the issuance of 3 licenses.

Projects were inspected during the month in Inyo, Kern, San Bernardino, Los Angeles, Ventura, Santa Barbara and San Luis Obispo counties, preparatory to the issuance of licenses confirming the rights under permits heretofore issued.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

The field work is now going forward on the regular summer schedule and all points of diversion and return flows are being visited and discharge measurements made. The stream flow into the delta on the Sacramento River and at Vernalis on the San Joaquin River was decreasing at a rapid rate and was comparable to the 1934 flow until May 20th, when the effect of a rather short and heavy storm was shown in rising river levels. The downward trend of the flow of the San Joaquin at Vernalis was checked, but the flow of the Sacramento River at Sacramento increased about 7000 cubic feet per second, the flow on May 20th being about 5000 cubic feet per second and on May 25th, 12,000 cubic feet per second.

The storm did considerable damage to ripening crops, but was of help to the rice and beet men. At the outset of the season

(Continued on page 25)

Highway Bids and Awards for the Month of May, '39

SAN BERNARDINO COUNTY—A reinforced concrete slab bridge across Cucamonga Wash to be extended with two 30-foot spans. District VIII, Route 9, Section A. Matich Bros., Elsinore, \$13,310; Carl Hallin, Los Angeles, \$13,485; G. E. Kerns, Long Beach, \$13,852; Valley Construction Co., San Jose, \$13,997; Gibbons & Reed, Burbank, \$14,733; Oberg Bros., Los Angeles, \$14,872; R. M. Price, Huntington Park, \$14,881; C. R. Butterfield Kennedy Co., San Pedro, \$15,000; Anderson & France, Visalia, \$15,050; Byerts & Dunn, Los Angeles, \$15,165; Franklin B. Gridley, Pasadena, \$15,179; H. A. Teget, Ontario, \$15,662; The Contracting Engineers Co., Los Angeles, \$15,664; V. L. & W. B. Jacobson, Los Angeles, \$15,988; W. H. McTune, Monrovia, \$15,996; J. S. Metzger & Son, Los Angeles, \$16,885; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$17,815. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$12,621.50.

YOLO COUNTY—At Knights Landing, a reinforced concrete slab bridge on steel pile bents to be constructed and about 0.18 mile of roadway to be graded and roadmix surface treatment applied. District III, Route 88, Section A. E. T. Lesure, Oakland, \$29,751; L. C. Seidel, Oakland, \$29,784; E. E. Smith, Eureka, \$29,829; A. A. Tieslau, Berkeley, \$31,859; P. F. Bender, North Sacramento, \$32,140; J. S. Metzger & Son, Los Angeles, \$33,992; Lindgren & Swinerton, Inc., Sacramento, \$34,362; Albert H. Siemer and John Carcano, San Anselmo, \$35,815; Holdener Construction Co., Sacramento, \$31,655. Contract awarded to R. G. Clifford, San Francisco, \$28,619.50.

TULARE COUNTY—A reinforced concrete bridge across Kings River about 2 miles south of Kingsburg to be constructed. District VI, Route 4, Section E. Heafey-Moore Co. & Frederickson & Watson Construction Co., Oakland, \$114,413; United Concrete Pipe Corp., Los Angeles, \$114,416; Earl W. Heple, San Jose, \$119,069; R. G. Clifford, San Francisco, \$121,058; Sordal and Bishop, Long Beach, \$122,823; Paul J. Tyler, Oroville, \$124,380; D. W. Nicholson, Oakland, \$125,274; A. Teichert & Son, Inc., Sacramento, \$126,716; J. S. Metzger & Son, Los Angeles, \$128,721; Trowitt-Shields & Fisher, Fresno, \$129,272; Union Paving Co., San Francisco, \$131,407; C. W. Caletti & Co., San Rafael, \$131,820; Maceo Construction Co., Clearwater, \$136,221; M. B. McGowan, Inc., San Francisco, \$139,019; J. E. Haddock, Ltd., Pasadena, \$156,644. Contract awarded to A. Soda and Son, Oakland, \$109,168.84.

SANTA CRUZ AND SANTA CLARA COUNTIES—Between Woodwardia and Hall's bridge, about 2.9 miles to be graded and surfaced with crusher run base and armor coat. District IV, Feeder road. N. M. Ball Sons, Berkeley, \$64,919; Jack Casson, Hayward, \$66,093; Heafey-Moore Co., Frederickson & Watson Construction Co., Oakland, \$68,487; M. J. Ruddy, Modesto, \$74,781; Mountain Construction Co., Sacramento, \$73,261; J. L. Conner and Sons, Ukiah, \$72,613; Valley Construction Co., San Jose, \$76,443; Frederickson & Westbrook, Sacramento, \$69,860; Piazza & Huntley, San Jose, \$80,259; L. C. Karstedt, Watsonville, \$87,810; H. Earl Parker, Marysville, \$71,969; Maceo Construction Co., Clearwater, \$71,190. Contract awarded to Eaton & Smith, San Francisco, \$62,273.70.

YUBA COUNTY—Between 1.5 miles southwest of Chipper Mills and Challenge, about 4.8 miles to be graded and surfaced

Division of Water Resources Report

(Continued from page 24)

indications were that the rice acreage planted this year would closely approximate that of 1938, but due to the dry spring a large amount of land which had been sown to grain was ploughed and rice planted instead.

COOPERATIVE SNOW SURVEYS

The results of the May 1st snow surveys (the final one scheduled for issue this season) released May 10th, necessitated revision of the stream-flow estimates made a month previous.

The reductions in run-off are greater in the north where there was a more severe deficiency in April precipitation. The overall reduction in the April-July run-off forecasts amounts to 17 per cent of the figures published in April, which reduces the overall expectancy of the run-off during the four months' snow melting period from 48 per cent of normal—as published in April—to 40 per cent of normal.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento River Flood Control Project

Minor repairs to the flood control works have been carried on during this period. No storms or floods have occurred this season, eliminating the necessity for the usual spring repairs. The new truck and storage shed at the Sutter maintenance yard is nearing completion, with the installation of sliding doors.

The flowage area of the Knights Landing Ridge Drainage Cut is being cleared with the aid of WPA labor, an average of 30 men having been engaged in this work during the period.

Sacramento Flood Control Project Construction

The Reclamation Board has requested the division to construct one bridge and three concrete crossings on Dry Creek in Yuba

with untreated crushed gravel or stone surfacing and a seal coat to be applied. District III, Feeder road. M. J. Ruddy, Modesto, \$54,508; Ponlos & McEwen, Sacramento, \$56,084; Valley Construction Co., San Jose, \$56,626; Hemstreet and Bell, Marysville, \$57,229; Frederickson & Westbrook, Sacramento, \$58,533; J. P. Brennan, Redding, \$63,433; Piazza & Huntley, San Jose, \$65,267. Contract awarded to R. P. Shea & Del R. Beebe, Glendale, \$52,712.60.

LOS ANGELES COUNTY—Over Arroyo Seco Channel and Arroyo Seco Parkway, at Avenue 43, a reinforced concrete girder bridge to be constructed and roadway approaches to be graded and paved with asphalt concrete. District VII, Route 205, Section L. A. Oberg Bros., Los Angeles, \$47,670; Byerts & Dunn, Los Angeles, \$47,829; J. S. Metzger & Son, Los Angeles, \$48,618; United Concrete Pipe Corp., Los Angeles, \$51,328; J. E. Haddock, Ltd., Pasadena, \$51,767; Heuser & Garnett, Glendale, \$52,415; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$54,589; Carlo Bon-giovanni, Hollywood, \$55,535. Contract awarded to The Contracting Engineers Co., Los Angeles, \$42,551.50.

County at a cost of approximately \$5,000. This work will be undertaken immediately.

Work was continued in clearing the Tisdale By pass channel and the Feather River overflow with WPA labor.

Relief Labor Work

Under WPA Project No. 10612, sponsored by this department, a total of 15,321 man-hours of labor have been applied from April 23 to May 26, inclusive, 1939, equivalent to a continuous working force of 189 men working eight hours per day.

A contract has been awarded to Peter F. Bender for \$6,200 for construction of two timber bridges in the Tisdale By pass. Piles have been driven for two additional bridges in the Sutter By pass and the decks will be placed within the next two weeks with assistance of WPA labor. Repairs to several other bridges have been made.

The repair of wave wash damage on the east levee of the Sutter By-pass and of breaks in the Nelson Bend Bow Levee has been practically completed. Repair of the Butte Basin Levee along the Sacramento River will be commenced about June 5th.

Preparations are complete for resumption of levee repair work on River Junction Reclamation District No. 2064 in San Joaquin County and additional work will cost approximately \$4,600. This work will be carried on by force account by the division.

Praise for Maintenance Men

San Jose, California, May 5, 1939
Division of Highways,
Sacramento, California
Gentlemen:

I want to put in a boost for the maintenance crews of the Division of Highways. These hard working and conscientious employees are the backbone of our highway system. They keep the roads traversable. The better the job they do, the less credit they get. The public has come to expect a perfect road as a matter of course and utter loud complaints over any inconsequential chuckhole.

What started me on this was an incident I observed on May 4 about 10 a.m. on U. S. 101 between Santa Clara and Sunnyvale where I saw a member of the maintenance crew digging a grave to bury a large dog that evidently had been the victim of some passing motorist. I understand that the burial of an animal killed on a highway is not a responsibility of the maintenance crews and that in this particular case the job was taken over on the initiative of the crew members. It was a kind act and one that would seem to call for commendation of maintenance men by all persons who have any regard for the dogs and cats that are victims of present day traffic.

HARRY G. SHAW,
1227 Minnesota Ave.,
San Jose, California

The Bronx-Whitestone bridge across the East River in New York City opened April 29th. It is an \$18,000,000 span, a vital link in a great belt highway. Traffic is accommodated in six broad lanes, three lanes for traffic in each direction. Northbound and southbound traffic is separated by a raised concrete barrier.



One of the scenes of sylvan beauty on the realigned Route 2 between Gaviota Pass and Santa Ynez River.

Nojoqui Canyon Realignment Abolishes 19 Curves

(Continued from page 9)

The performance of this equipment was satisfactory.

The Portland cement concrete pavement section was 22 feet wide, 0.55 foot thick, with the outer edges thickened to 0.75 foot. Weakened plane and expansion joints were reinforced with single $\frac{1}{2}$ -inch transverse bars and $\frac{3}{4}$ -inch dowels; $\frac{3}{4}$ -inch tie bolts at 4-foot centers were placed along longitudinal joint. The pavement was placed half-width at a time.

PAVING PROGRESS DELAYED

The first paving operations began October 11, 1938. As three of the bridges and a part of the grading were not completed, it was necessary for the contractor to skip paving the central portion of the project. Paving was not completed until March 29, 1939. The slow progress made may be attributable to delays caused by weather, occurrence of slides and changes in bridge footings.

In the early stages of paving operations, considerable difficulty was experienced in obtaining aggregates from nearby commercial

sources that would uniformly pass the sulfate tests for soundness. It became necessary to require material to be stockpiled several weeks in advance of use, so that time for tests for acceptability could be made. The first 1600 cubic yards of pavement poured required the blending with a high sulfate-test aggregate from San Gabriel River plants. As the work progressed, the local commercial aggregate became more uniform in acceptability, probably due to obtaining it from a better portion of the pit, permitting its use for the remainder of the paving period.

Steel headers were used. Where the supporting stakes punctured the asphalt membrane seal, the contractor was required to reseal the punctures, upon removal of the headers, with SC-2 liquid asphalt.

ADEQUATE DETOURS CONSTRUCTED

Either constructed detours or existing roadbed outside of new slope stakes were available for traffic over most of the project. Numerous crossings of the work, however, were necessary, due to the crooked and meandering alignment of the

old road. Constructed detours consisted of a graded roadbed topped with 0.5 foot imported borrow, the upper 0.33 foot of which was road-mixed with SC-12 liquid asphalt.

Work was completed April 21, 1939, and acceptance by the director was on May 2, 1939.

W. J. Curran and R. A. DeLano, were successively superintendents for C. O. Sparks and Mundo Engineering Corporation, Contractor; and J. C. Adams was resident engineer for the State.

The work was a Federal Aid Project; total construction cost, including the four bridges, was approximately \$307,000.

Demand For Magazine

April 13, 1939

Department of Public Works,
Sacramento, California

Many people are asking for this magazine. If there is no charge for it, could it be sent monthly to the Broadmoor County Branch Library, 642 Dowling Boulevard, San Leandro. Thanks.

M. R. L.,
Broadmoor County
Library Branch



Congratulations

Downtown Improvement Association
Sacramento, California

Mr. John W. Howe, Editor,
California Highways and
Public Works,
P. O. Box 1499,
Sacramento, California.

Dear Mr. Howe:

We read your publication from cover to cover and enjoy every article, which are all very instructive and educational. It is through your magazine that we keep informed of the splendid work being done by the Department of Highways and Public Works for the benefit of the general public throughout the State of California.

May we extend to you our congratulations and best wishes for continued success in your good work.

Sincerely yours,

Downtown Improvement Association,
By Roy Cothrin, Managing-Director.

Texas Wants Index

The State of Texas

State Highway Department
Austin

California Highways and
Public Works,
Sacramento, California.

Gentlemen:

We will appreciate your sending us an index or table of contents to the 1938 issues of California Highways and Public Works if you compile one. We have your publication in our Department Library, and such an index would be of great advantage to our engineers.

Sincerely yours,
Julian Montgomery,
State Highway Engineer.

A Boost from Kern County

1914 Maple Avenue,
Bakersfield, California.

Editor, Highway Bulletin,
Sacramento, California.

Dear Mr. Howe:

For a number of years we have been enjoying the Highway Bulletin, and think that it is one of the finest of its kind.

For a period of years my husband was in the road construction work, and being an engineer, reviewed your magazine from an engineer's view point.

I was principal of a Junior High school, and used the magazine in the social studies classes to a great advantage, after which it was put in the school library, and used daily until ready for discard.

There are so many fine articles and photographs of construction work that is being done in Kern County within its pages, that it makes it especially valuable for use here.

We were especially interested in the article in a recent issue describing the New Divided Highway, which is a joy to all who use it.

Thank you for keeping us on your mailing list, and permit me to congratulate you upon the superior publication of an excellent magazine.

Very sincerely yours,

JUNE CARNAHAN.

From Kentucky

City of Louisville
Kentucky

California Highways and
Public Works,
Sacramento, California.

Gentlemen:

Will you kindly put the City of Louisville on your mailing list for your magazine directing it to me at this office. We will greatly value receiving it so that it may be read and preserved in our library.

Thanking you, I remain.

Very truly yours,

DEPT. OF PUBLIC WORKS,
J. B. Wilson, Chief Engineer,
Room 214,
City Hall, 6th and Jefferson,
Louisville, Kentucky.

Bestows Praise

To the Editor,
California Highways and
Public Works,
Sacramento, California.

My dear Sir:

If I did not take this opportunity of congratulating you upon the slant you are giving the road situation in our State I would indeed be derelict in public duty, for I hold it just as needful to bestow

praise as blame. I refer to the illustrations of poor roads on pages 4, 5, 6, and 7 of your January issue. The very looks of the roads were enough to send the shivers down one's back because of their horror possibilities. Your monthly tries to get us away from that difficult state of mind—provincialism. It also tends to make us conscious of the fact that other States have good roads and are spending even more than California only, as an Illinois resident once pointedly remarked when I praised their road systems "Yes, we have good roads in Illinois—only we don't talk about them!"

Sincerely yours,

FORD A. CARPENTER.

Teacher is Interested

346 W. Park St.,
Stockton, Calif.
January 9, 1939.

California Highways and
Public Works,
Sacramento, Calif.

Gentlemen:

Kindly place me on your mailing list for your publication, "California Highways and Public Works."

I am a teacher and I feel that your publication would be a splendid reference to have on hand enabling children to know what is going on in highway construction throughout the State, and how wisely our tax money is being spent in this department.

Thank you for this favor,

Cordially yours,

L. A. FARRAR.

City of Glendale

California Highways and
Public Works,
Sacramento, California.

Dear Sirs:

I have just read a borrowed copy of your publication "California Highways and Public Works," with much interest. I believe this publication will help me in my present position and would like very much to be placed on your mailing list.

Thanking you very much, I am

Very truly yours,

M. F. EATON, State Foreman,
4844 San Fernando Road,
Glendale, California.

Gas Tax Apportionments to Cities During Biennium

(Continued from page 17)

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
San Bernardino County			
Chino	\$2,826.54	\$2,829.63	\$5,656.17
Colton	7,264.87	7,274.75	14,539.62
Needles	2,850.11	2,853.22	5,703.33
Ontario	12,313.29	12,326.75	24,640.04
Redlands	12,851.77	12,865.82	25,717.59
Rialto	1,488.50	1,490.12	2,978.62
San Bernardino	35,416.01	35,454.73	70,870.74
Upland	4,272.43	4,277.11	8,549.54
Totals	\$79,283.52	\$79,372.13	\$158,655.65
Totals District VIII	\$121,443.15	\$123,894.73	\$245,337.88

District IX

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
Inyo County			
Bishop	\$1,050.65	\$1,051.80	\$2,102.45
Mono County			

District X

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
Amador County			
Amador City	\$155.01	\$155.18	\$310.19
Jackson	1,817.57	1,819.57	3,637.14
Plymouth	310.94	311.28	622.22
Sutter Creek	918.31	919.31	1,837.62
Totals	\$3,201.83	\$3,205.34	\$6,407.17
Calaveras County			
Angels	\$829.47	\$830.38	\$1,659.85
Mariposa County			
Hornitos	\$56.20	\$56.26	\$112.46
Merced County			
Atwater	\$831.28	\$832.19	\$1,663.47
Dos Palos	843.07	844.00	1,687.07
Gustine	921.03	922.03	1,843.06
Livingston	727.93	728.73	1,456.66
Los Banos	1,699.74	1,701.58	3,401.32
Merced	6,405.48	6,412.48	12,817.96
Totals	\$11,428.53	\$11,441.01	\$22,869.54
Sacramento County			
Isleton	\$2,634.35	\$2,637.23	\$5,271.58
San Joaquin County			
Lodi	\$6,596.76	\$6,603.98	\$13,200.74
Manteca	1,463.13	1,464.73	2,927.86
Stockton	43,479.53	43,527.06	87,006.59
Tracy	3,471.07	3,474.86	6,945.93
Totals	\$55,010.49	\$55,070.63	\$110,081.12

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
Solano County			
Benicia	\$2,640.70	\$2,643.59	\$5,284.29
Dixon	906.52	907.51	1,814.03
Fairfield	1,025.27	1,026.40	2,051.67
Rio Vista	1,186.64	1,187.94	2,374.58
Suisun	820.41	821.30	1,641.71
Vacaville	1,410.55	1,479.34	2,889.89
Vallejo	13,848.93	13,864.08	27,713.01
Totals	\$21,839.02	\$21,930.16	\$43,769.18

Stanislaus County			
Ceres	\$889.31	\$890.27	\$1,779.58
Modesto	12,566.94	12,686.79	25,253.73
Newman	1,150.38	1,151.63	2,302.01
Oakdale	1,914.58	1,916.67	3,831.25
Patterson	820.40	821.30	1,641.70
Riverbank	727.93	728.73	1,456.66
Turlock	3,876.28	3,880.53	7,756.81
Totals	\$21,945.82	\$22,075.92	\$44,021.74

Tuolumne County			
Sonora	\$2,065.06	\$2,067.32	\$4,132.38
Totals District X	\$119,010.77	\$119,314.25	\$238,325.02

District XI

CITY	STREETS OF MAJOR IMPORTANCE Section 194		STATE HIGHWAYS Section 203
	Fiscal Year Ending June 30, 1938	Fiscal Year Ending June 30, 1939	Biennium Ending June 30, 1939
Imperial County			
Brawley	\$9,463.19	\$9,473.53	\$18,936.72
Calixico	5,710.18	5,716.42	11,426.60
Calipatria	1,408.74	1,410.27	2,819.01
El Centro	7,645.60	7,653.97	15,299.57
Holtville	1,593.67	1,595.41	3,189.08
Imperial	1,761.37	1,763.30	3,524.67
Westmorland	1,338.03	1,339.48	2,677.51
Totals	\$28,920.78	\$28,952.38	\$57,873.16

Riverside County			
Blythe	\$924.66	\$925.66	\$1,850.32
Indio	2,357.86	2,360.45	4,718.31
Totals	\$3,282.52	\$3,286.11	\$6,568.63

San Diego County			
Chula Vista	\$3,507.34	\$3,511.17	\$7,018.51
Coronado	4,917.88	4,923.26	9,841.14
El Cajon	951.84	952.89	1,904.73
Escondido	3,101.21	3,104.60	6,205.81
La Mesa	2,278.10	2,280.59	4,558.69
National City	6,618.52	6,625.75	13,244.27
Oceanside	3,185.52	3,189.00	6,374.52
San Diego	137,512.05	137,664.31	275,176.36
Totals	\$162,072.46	\$162,251.57	\$324,324.03
Totals District XI	\$194,275.76	\$194,490.06	\$388,765.82

State of California

CULBERT L. OLSON, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

FRANK W. CLARK, Director of Public Works

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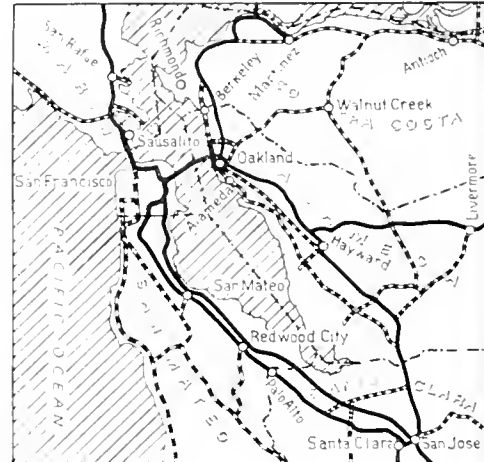
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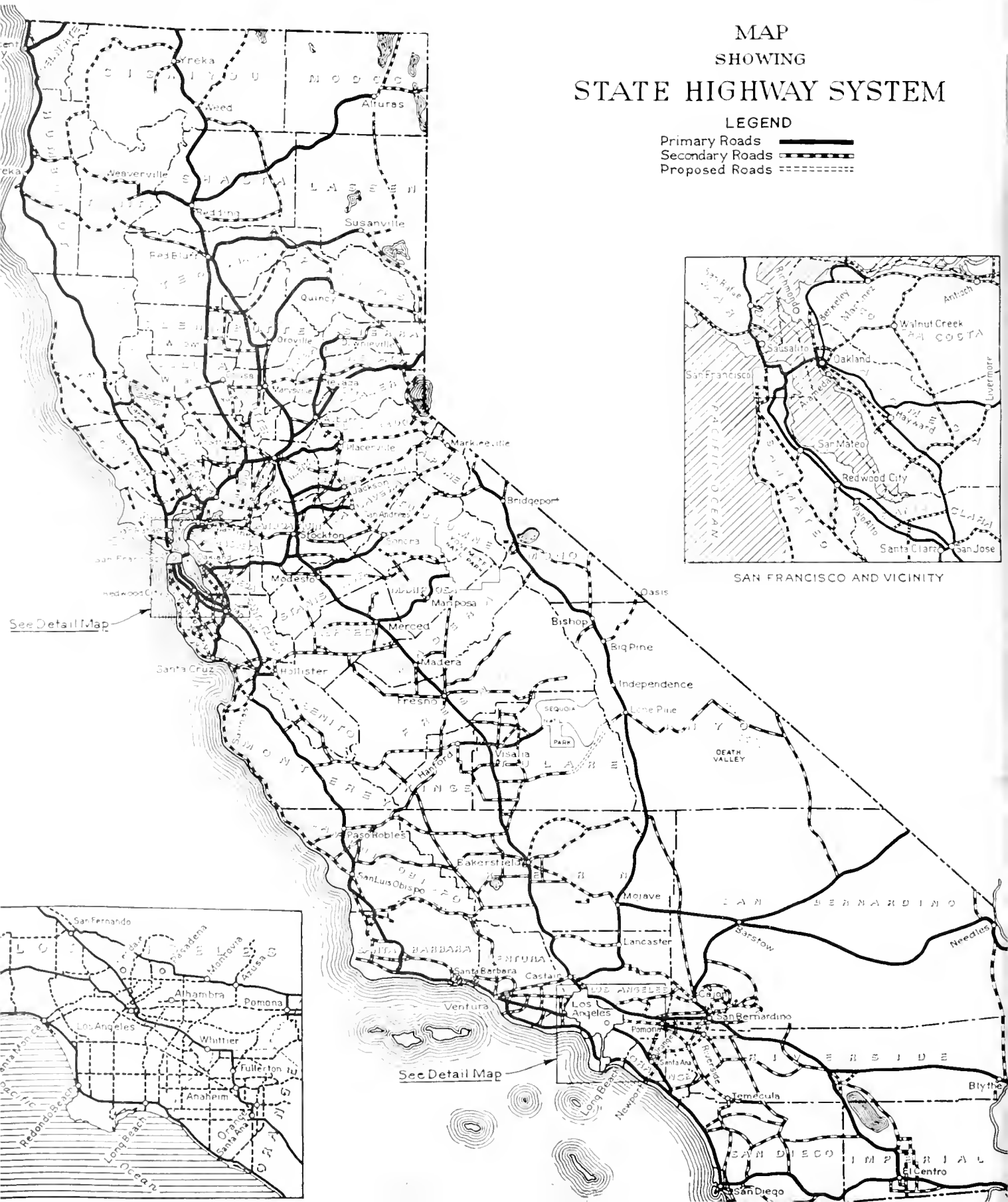
MAP SHOWING STATE HIGHWAY SYSTEM

LEGEND

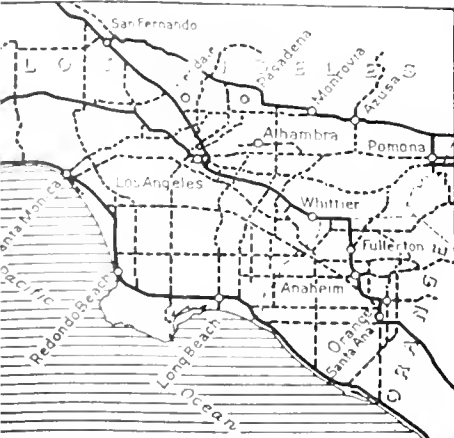
Primary Roads —————
Secondary Roads - - - - -
Proposed Roads = = = = =



SAN FRANCISCO AND VICINITY



See Detail Map



CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



SCENIC STRETCH OF RECENTLY COMPLETED NEWHALL TUNNEL
HIGHWAY, STATE ROUTE 20, LOOKING SOUTH FROM HISTORIC
FREMONT PASS IN LOS ANGELES COUNTY

JULY
1939

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

Published for information of the members of the department and the citizens of California

Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request

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Vol. 17

JULY, 1939

No. 7

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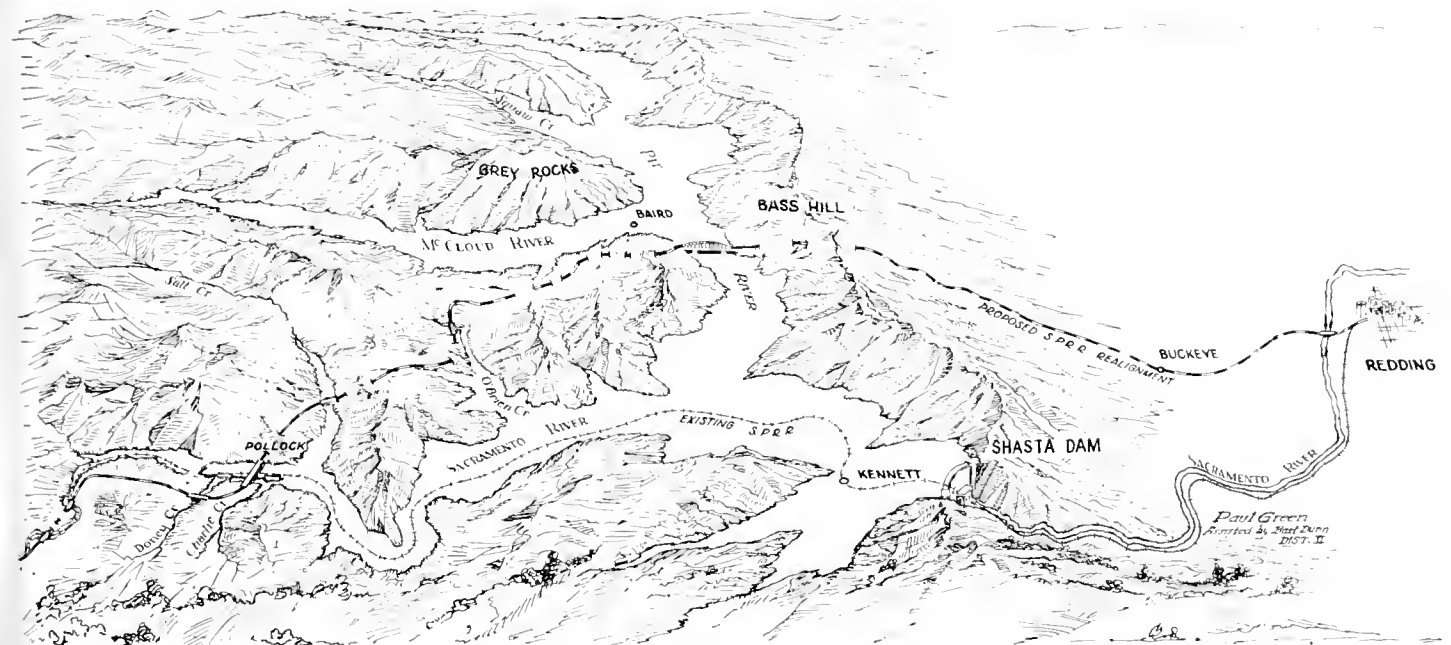
Relocating of Southern Pacific Railroad for the Development of Shasta Dam Will Cost \$17,500,000

THE Shasta dam development of the Central Valley Project includes a major piece of supplemental construction work comprising the required relocation of the present main line of the Southern Pacific Railroad (Shasta Route) around the reservoir which the dam will create. The new railroad now being built to replace the existing line between Redding and Delta will require an estimated capital expenditure of \$17,500,000.

reconnaissance surveys a route on the east side was selected that generally follows the location finally adopted. It was the basis for cost estimates on the Kennett (Shasta) reservoir development in reports on the State Water Plan prepared under the direction of Edward Hyatt, State Engineer. In 1930 a preliminary survey was run by the U. S. Army Engineers along the west side of the reservoir, which again proved that the east side route was the more favorable one.

location selected and the plans prepared as a result of this survey are practically the same as the final location and plans subsequently adopted.

Preliminary negotiations for an agreement with the Southern Pacific Company for the relocation of the railroad were also carried out by the Division of Water Resources on behalf of the Water Project Authority in conformity with a cooperative contract between the Authority and the U. S. Bureau of Reclamation. A pre-



Sketch map shows existing Southern Pacific railroad line and route trains will follow from Redding after relocation.

This job of railroad building constitutes a large and notable construction undertaking in itself, and would be receiving greater notice were it not for the fact that it is dwarfed by the much larger and more outstanding construction work on the dam.

The original reconnaissance surveys for this railroad relocation were made by Paul Bailey, former State Engineer, and A. D. Edmonston, Deputy State Engineer, in 1925, including investigation of alternate routes on both sides of the river. As a result of these

In January, 1935, prior to allocation of emergency funds for the Central Valley Project by President Roosevelt, the legislature appropriated funds for an additional survey. This survey was made by the Southern Pacific Company under a contract with the Division of Water Resources, and was directed by Russell Chase, veteran locating engineer, and J. A. Given, Division Engineer, Shasta District, for the company. Complete plans and estimates of cost were prepared and submitted in a report. The

liminary draft of agreement between the company and the United States covering the proposed relocation was prepared and submitted to the Bureau of Reclamation. The final contract somewhat modified from the preliminary agreement drafted, was executed in September, 1938.

U. S. STANDS COST

The agreement, as executed, provides for the construction of a new railroad to replace the existing line at the entire expense of the United



By-pass tunnel through west abutment of Shasta Dam, recently placed in operation as temporary route for trains to permit construction to proceed on the dam without interference to traffic.

States. All construction is to be handled by the United States except the laying of ties and rails and the installation of an electric signal and block system which is to be done by the Southern Pacific Company and the cost thereof plus 10 per cent borne by the United States. Upon completion, the railroad company will be given sixty days within which to use the new line on a trial basis; and after acceptance is given the right to demand payment, within a period of five years, of not to exceed \$350,000 for unusual maintenance costs actually incurred.

The location of the new railroad line and its relation to the existing line is shown on the accompanying perspective sketch. The existing line between Redding and Delta, built in 1884, follows a grade on a tortuous course through the Sacramento River canyon 37 miles in length. The new line leaves the existing line at the city of Redding (elevation 559 feet); crosses the Sacramento River on a steel bridge and viaduct 4346 feet in length and then proceeds on an ascending grade to the crossing of the Pit River at an elevation of 1110 feet.

This section includes the two longest tunnels on the new line, each

about 2700 feet long. After crossing the Pit River on a bridge, subsequently described, the new line continues on an ascending grade to O'Brien's Summit (elevation 1218 feet) and then continues on a descending grade to the second crossing of the Sacramento River. From this point the new line follows alternately the westerly and easterly sides of the river making two more crossings before joining the existing line at an elevation of 1123 feet near Delta.

There will be five tunnels between the Pit River and O'Brien's Summit, the longest of which is 1900 feet in length; three tunnels between O'Brien's Summit and the second crossing of the Sacramento River, the longest of which is 2235 feet; and two tunnels between the third and fourth crossings of the Sacramento River, the longest of which is 1000 feet.

The total length of the new line is approximately thirty miles. It includes twelve tunnels with an aggregate length of 19,110 feet, and eight major steel bridges aggregating 12,856 feet in length.

The construction of the new line will involve the excavation and grading of 3,900,000 cubic yards including 2,100,000 cubic yards of rock,

and 420,000 cubic yards of tunnel excavation. It will require 5915 gross tons of new rail for the main track and 1331 gross tons of old rail to be salvaged from the existing line and used for sidings; 12,643 tons of bridge steel exclusive of that for the Pit River bridge which will require 16,400 tons; and large quantities of other material.

As with the existing line, the new line will be a single track railroad although the foundations of certain structures are being built in such a manner that double tracking may be accomplished at some later time. However, as compared to the existing line it will be superior in many respects. It will have a maximum grade of 0.9 per cent, a total curvature of 2028 degrees as compared to 7129 degrees on the old line, and a maximum curvature of 4 degrees as compared to 11 degrees on the old line. Considering limitations of curvature the new line will permit train speeds up to sixty miles per hour for passenger trains as compared to twenty miles per hour on portions of the present line. It is estimated that the running time between Redding and Delta will be decreased by forty-five minutes for

(Continued on page 23)



Construction progress on Southern Pacific Railroad relocation, Redding to Delta. Upper—4346-foot railroad bridge crossing Sacramento River near Redding. Center—One of twelve tunnels under construction. Lower—Completed section of grading north of Redding.

Realignment of Russian River Highway Nearing Completion

By W. A. RICE, Resident Engineer

THE district adjacent to the Russian River in Sonoma County is one of the popular vacation spots and playgrounds in Northern California.

The section between Northwood Park and Guerneville has been

The town of Guerneville, located at one end of this project, is on the Russian River. It was first settled around 1860 and became the center of a thriving lumber community. It was named after Mr. George Guerne, who was one of the early settlers.

these monuments to the majestic trees that at one time stood everywhere in this section still remain. They are scattered among the vineyards and orchards of the region.

The lumber industry ended about 1919 and this section of the river



View of existing Northwood Park-Guerneville highway showing sharp curves and grades. This highway will be replaced by new construction on easy curvature and practically level grades.

served by a narrow, winding road which has been inadequate to accommodate the heavy summer traffic using it during the last several years.

At one time it was known as Stump Town because of the many Redwood stumps left standing throughout the village. Many of

rapidly developed into a popular recreational center. The heavy increase of traffic, due to this development, has made it necessary to construct



This picture shows construction crew back-filling bulkheads with porous river gravel.

a realigned standard highway to accommodate steadily increasing travel.

In contrast with the existing road the new road will have easy curves and very light grades. The roadbed of the abandoned Northwestern Pacific Railroad is utilized for the new road.

The new road follows closely along the river for practically its entire length of 3.23 miles, passing through the beautiful stand of Redwood trees in Guerneville Park. The view of the river and of the beaches to be obtained from the new road is unsurpassed.

ROADBED 36 FEET WIDE

The roadbed will be 36 feet throughout, except where the topography made it necessary to construct retaining walls along the river side of the road. At these places the width was reduced to 28 feet. The surfacing will consist of one foot of river gravel on the graded roadbed and an armor coat surface.

At most locations where the rail-

road found timber trestles to be satisfactory and where the new fills would not catch, retaining walls were constructed. They consist of steel "H" beams driven at 8 foot centers, lagged with 6-inch by 12-inch treated Douglas fir timber, and anchored by steel rods to steel piles driven into the roadbed section.

The steel "H" beams were 10-inch, 42-lb. beams driven to one-half the height above ground or to refusal. The driving was through a shaly material and little difficulty was experienced in driving. The required bearing of a minimum of 5 tons for a penetration of 18 feet or under, and 2 tons for a penetration of more than 18 feet, was obtained without difficulty.

ANCHOR AND BULKHEAD PILES

The anchor piles were of the same material as the bulkhead piles. They were driven to one-half the height of the bulkhead piles above ground with a minimum of 5 feet. Treated Douglas fir bearing blocks, 8 inches

by 12 inches by 6 feet long, were placed on the bulkhead side of the anchor piles to assist in carrying the load.

Timber lagging consisted of 6-inch by 12-inch treated Douglas fir timber. It was placed on the road side of the bulkhead piles. Placing was started from the bottom. Every third plank was separated by a spacer block of treated timber. These were 4 inches by 8 inches by 3 feet long and shaped to fit around the piles. Steel "I" bolts held them in position against the piles; drift pins were used to secure them to the timber lagging.

The rods were of steel. The top row was placed three feet down from the top of the bulkhead piles and was of one inch round material. The second row was placed, as necessary, a maximum of ten feet below the top row, and was of 1½-inch round material with upset ends and malleable washers. The third row of ties was placed, as necessary, and was of 1½-inch

(Continued on page 27)

Bank Protection and Revetment as Viewed in the Light of the Unprecedented Storms in California During the Winter of 1937-8

By G. A. TILTON, Jr., Asst. Const. Engineer

FOLLOWING widespread storms of severe intensity throughout the State during the winter of 1937-8, particularly the December, 1937, storm in Northern California and the February-March, 1938, storm in Southern California, interest in bank protective measures was promptly revived.

Not since 1914 and 1922 had California engineers had an opportunity to observe the effect of severe storms on bank protection and revetment throughout the State. Intermittently during the 16 to 24 years preceding the winter of 1937-8, localized storms producing a heavy runoff have occurred to test one type or other but none occurred that was sufficiently severe and general in character to produce comparable tests of all types at one time.

Promptly following the clearing away of wreckage after the February-March, 1938, storm in Southern California, the State Division of Highways launched a joint departmental survey and intensive study of the effectiveness of individual types throughout the State.

SURVEY FINDINGS

Several outstanding observations were readily correlated:

(1) No one type of revetment or bank protection in general use that was encountered in the survey gave 100 per cent service under the severe action of the unprecedented runoff. One type of protection would withstand damage in a particular location and fail in another. This held true whether designed and built by governmental agencies, public utilities, or private parties.

(2) With but few exceptions, the

initial cause of failure or partial failure of all of the various types of bank protection or revetment could be attributed to undermining or scouring of the bottom of the installation by high velocity currents.

(3) In cases of complete failure, it was of particular note that the protective measures returned their worth in preventing, delaying, or minimizing damage even though completely lost in the end.

(4) On most streams, tangent sections suffered comparatively little, but vulnerable places would develop on bends of the same stream at a point where the center-line tangent of the stream flow, whether narrow or wide, intersected the outer bank of the downstream curve.

(5) Channel restrictions were the cause of increased velocities in numerous cases that induced damaging scour. Putting rock dykes, heavy growth of trees, bridge piers, and abutments, encroaching approach fills, and conflicting flows at the confluence of major streams, all told the same story.

(6) Types requiring frequent maintenance or renewal such as those incorporating untreated timber, suffered correspondingly more than enduring types that require but little maintenance.

DETAILED STUDY

For the purpose of a detailed comparative study, all types encountered were grouped into four classifications:

Class "A"—Revetment or facing types constructed on prepared bank slopes.

A-1 Clean graded heavy rock riprap.

A-2 Sack concrete.

A-3 Asphalt concrete mattress.

A-4 Rock and wire mattress.

A-5 Gunite facing with articulated aprons.

A-6 Reinforced concrete slope paving.

A-7 Grouted rock facing.

A-8 Hand-placed rock facing.

A-9 Random select bank-run rock riprap.

Class "B"—Fence types requiring no prepared bank slope.

B-1 Double and triple rows of cable-connected steel rail and wire mesh (brush and rock filler).

B-2 Double rows of heavy or light pipe and wire mesh (brush and rock filler).

B-3 Single row of rail or pipe fence with wire mesh.

B-4 Treated or untreated timber piling with wire mesh.

B-5 Timber pile bulkhead.

Class "C"—Permeable flexible types.

C-1 Steel tetrahedrons—cable-connected.

C-2 Concrete tetrahedrons—cable-connected.

C-3 Steel jackstraws—cable-connected.

Class "D"—Miscellaneous types.

With sixteen distinct classified types under consideration that gave varying degrees of service, the field was left wide open for improvement of the older designs of bank protection as well as for development of new designs.

The need for improvement and development is accentuated by state-

From top to bottom—Bank protected by sand bar formed down stream from steel tetrahedron jetty on Santa Clara River, Ventura County. Sacked concrete revetment with wire mesh and rock toe mattress, Eel River, Humboldt County. Sacked concrete revetment on Russian River, Mendocino County. Steel rail tetrahedrons on Salinas River, Monterey County.

ments of the Los Angeles County Flood Control District in their report of May 20, 1938, on the February-March, 1938, flood.

"From a meteorological point of view, worse conditions are possible and could be expected to produce a storm more intense and of longer duration than that which occurred from February 27 to March 4, 1938."

"* * * it is evident that there is no reason why a situation such as existed on March 2 could not continue for a much longer time interval and therefore cause considerably more rain than occurred then."

High mean velocities at peak discharge reported by the Los Angeles County Flood Control District on Southern California streams give some idea of accurate information now available to designers.

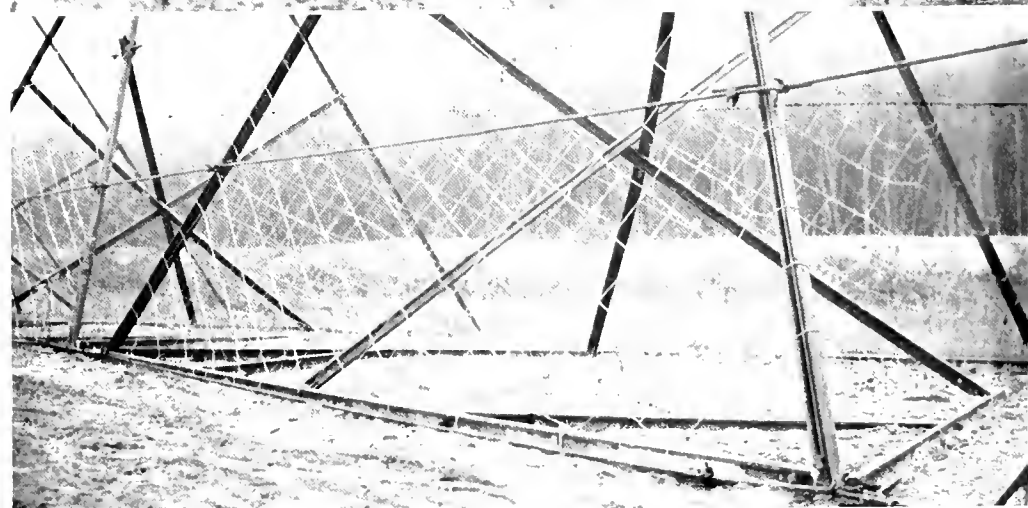
	Ft. per sec.
Los Angeles River at Dayton Ave. -----	24
Los Angeles River at Stewart and Gray Road -----	15
Los Angeles River at State St. -----	14
San Gabriel River at Foothill Blvd. -----	17
San Gabriel River at Spring St. -----	15
Rio Hondo above Mission Bridge -----	13.8
Rio Hondo at Stewart and Gray Rd. -----	15.6
Ballona Creek at Sawtelle Blvd. -----	12

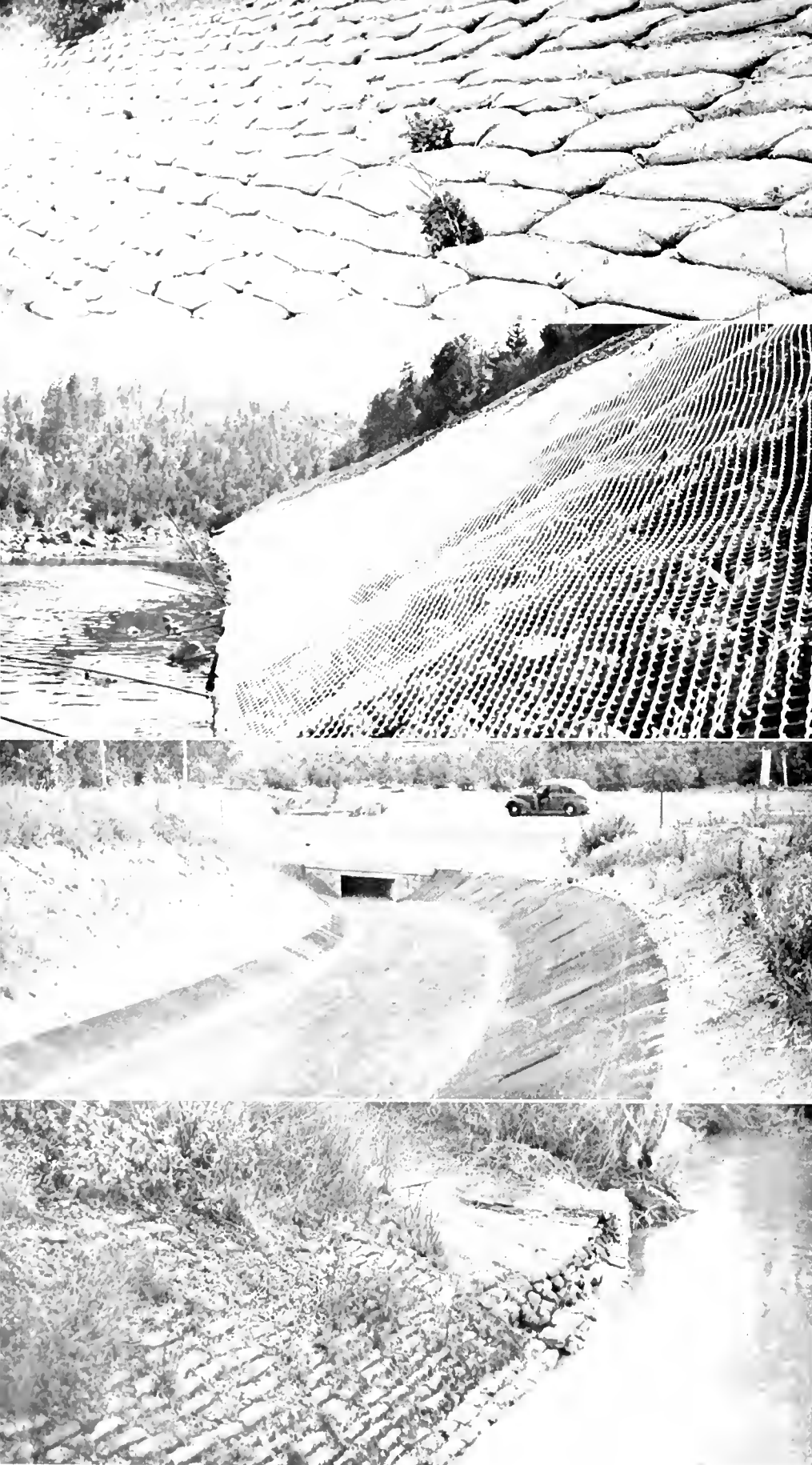
SERVICE OF CLASS "A" TYPES

Clean Graded Heavy Rock Riprap

Of all types encountered in the survey, *clean graded heavy rock riprap* proved to be the least vulnerable; the most effective; and in many cases, the most expensive.

Its flexibility and at the same time its ability to resist displacement through the interlocking action of the individual pieces of rock, make this





From top to bottom—Sacked concrete revetment on Grizzly Creek, Lake County. Heavy wire mesh revetment on Cow Creek in Shasta County. Reinforced asphalt concrete channel lining near Fillmore in Ventura County. Sacked concrete in use ten years on the Van Duzen River in Humboldt County.

type especially adaptable to use on embankments that are subjected to the impact of debris-laden high velocity flood waters. Complete success in common with other types, requires that the toe of heavy rock riprap be founded in a trench at or below anticipated scour. At times of excessive local scour, rock riprap tends to settle or slough without serious damage to the bank or levee and can be readily repaired during or after storms by dumping additional rock from the top of the bank.

Heavy rock riprap on slopes steeper than $1\frac{1}{2}:1$ is subject to serious sloughing when undermined.

Economic selection of this type depends primarily upon the reasonable cost of quarry rock of satisfactory quality, importance of the location, and seriousness of traffic interruption. Cost of heavy rock riprap varies from \$0.60 per ton where satisfactory rock can be selected from excavation close to the work, to \$2.50 per ton where rock has to be hauled or shipped greater distances.

Sack Concrete

Sack concrete revetment, in more general use in Northern California, gave excellent service during the December, 1937, storm.

Sack concrete installations consist of bank-run gravel, and in some cases fine sand, proportioned with cement at the rate of 3 to 4 sacks per cubic yard of mix. The mixture is placed in burlap sacks, tied and laid up in broken-joint tiers with mortar mulel oozing through the mesh of the burlap to form a moderate bond.

Compared to homogeneous types of revetment, sack concrete has the advantage, through arch action, of resisting complete failure even though a portion has been undermined and broken away. Although sack concrete has given satisfactory service on $1\frac{1}{2}:1$ slopes exceeding 30 feet in height, it appears advisable to limit installations on $1:1$ slopes to 10 feet in height. For greater heights not less than $1\frac{1}{2}:1$ slopes should be used.

The cost of sack concrete on a unit-area basis is second to clean graded heavy rock riprap and varies from \$7.50 to \$12 per cubic yard, or 30¢ to 40¢ per square foot of revetted surface. Economic selection is dependent primarily upon availability of local materials.

Asphalt Concrete Mattress

Asphalt concrete mattress installations were comparatively few in California at the time of the 1937-8 storms; but they gave such promising service under severe test that numerous installations have been

as can be observed at the time of this writing, low maintenance. From present indications it is probable that a weed killer may be advisable on the subgrade to prevent plant growth from penetrating cracks.

Flexible toe aprons of asphalt concrete that are adjustable to scour have been found through long experience to function successfully.

Reinforced Concrete Slope Paving

Reinforced concrete slope paving of varying thicknesses from 4 inches to 12 inches suffered badly from undermining of cutoff walls and generally

Rock and Wire Mattress

Flexible rock and wire mattresses 6 inches to 12 inches in thickness constructed on 2:1 slopes or flatter and protected with adjustable toe aprons of the same type, came through the 1937-8 storms with comparatively little damage.

This type of revetment is adaptable to vulnerable places on wide spreading streams of moderate to high velocities where flat bank slopes do not restrict the channel. Undercutting of the front of the toe mat permits the flexible mattress to adjust



Toe of gunite facing protected by conformance of articulated concrete block apron to scour on Pacoima Creek, Los Angeles County.

made since then. Of the Class "A" types of revetment, asphalt concrete is cheaper than any other type when compared on a unit-area basis; running from 11¢ to 19¢ per square foot.

Successful installations consist of 6 per cent to 10 per cent Grade "D" asphalt concrete reinforced with heavy-woven wire mesh and anchored with 2-inch galvanized iron pipe driven 5 feet into the prepared slope. Compaction to 3-inch or 4-inch thicknesses is accomplished with hand rollers. The principal advantages of asphalt concrete are: ease of construction, flexibility, low cost, and in so far

failed en masse when once damaged. Almost invariably the cause of failure could be traced to inadequate depth of cutoff or toe walls.

Reinforced concrete slope paving 4 inches to 6 inches thick is a highly satisfactory type of revetment when adequately anchored to the slope and founded on a cutoff wall designed deep enough to withstand scour. Greater thickness than 6 inches does not appear to be warranted. Cost varies from \$8 to \$14 per cubic yard of concrete, or 17¢ to 30¢ per square foot per 6-inch thickness including wire mesh.

itself to a scoured section and retard further disturbance.

Large boulders under the outer edge of the mattress toe tend to hold it up and permit the underlying material to wash away. To prevent scour from penetrating a greater distance under the mattress, large boulders under the toe at the surface should be removed.

Economic selection depends mainly upon availability of selected rock filling and hand labor. The likelihood of corrosion of the galvanized wire mesh should be considered as might

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CONSTRUCTION PROGRESS AND PAVEMENT RECORDS FOR 1938

By EARL WITHYCOMBE, Assistant Construction Engineer

FOUNDATION design continues to occupy the most prominent position in the planning of a project to insure that the support for the roadbed structure and for the pavement is adequate, under any and all seasonal conditions, to carry the designed load without failure.

During grading operations, rock is carefully conserved for use in the

of highways of major importance, the resulting height of cuts and the depth of embankments have taxed the ingenuity of engineers to design adequate foundations for the ever-increasing dimensions of the roadbed structure. Cuts in excess of two hundred feet and embankments in excess of one hundred fifty feet have become quite commonplace. To the deserving

lishment of soil-testing laboratories in the district headquarters, the elapsed time between sampling and the return of test data has been materially reduced. This has resulted in a decided improvement in the selection of the most suitable materials.

Standards of design with respect to depth of surfacing and depth of blanketing material for various subsoil



State Route 45 through Altamont Pass in Alameda County. Two 22-foot road-mix surface lanes with 4-foot dividing strip.

strengthening of foundations for embankments and structures. Where such material does not exist in the graded section, borrow from a local source is invariably provided to correct any existing weakness in the native geological structure over which the roadbed is to be constructed.

With the advent of the use of higher standards of grade and alignment in the construction and reconstruction

credit of the engineers charged with this feature of the design, it may be stated that failures of embankments from foundation weakness have become exceptionally rare in recent work.

SOIL TESTING IMPROVEMENT

Selection of soils within a project for use in the subgrade is being given increased attention. With the estab-

lishment of soil-testing laboratories in the district headquarters, the elapsed time between sampling and the return of test data has been materially reduced. This has resulted in a decided improvement in the selection of the most suitable materials.

Standards of design with respect to depth of surfacing and depth of blanketing material for various subsoil



State Route 2 near Morgan Hill in Santa Clara County, showing 33-foot asphalt concrete pavement.

Portland Cement Concrete

CONSTRUCTION METHODS

Automatic proportioning was used largely throughout the season's work to proportion aggregates for concrete paving mixtures. The results obtained in uniformity are very gratifying, and it is proposed to require this method on all major construction projects in the future.

Concrete with five sacks of cement to the cubic yard was used on 76 per cent of pavement construction. With the exception of a one-mile project, the remainder of the work was constructed with six sacks cement to the cubic yard.

A one-mile project in Orange County, between Orange and Olive, Contract 07XC8-87XC31, Road VII-Ora-181-A, was experimental in that the cement content was reduced to four sacks per cubic yard of concrete. During the progress of the work, a further reduction to three sacks per cubic yards of concrete was made on a 500-foot section in each 11-foot lane.

A surface application of sodium silicate was applied to one-half the area of the three-sack concrete to determine the effect of surface hardening. An exceptionally fine sand was used

in the low cement content mixtures, and they handled and finished remarkably well.

The ten-day compression tests averaged 2267 pounds per square inch for four-sack concrete and 855 pounds for three-sack concrete.

The twenty-eight-day compression tests averaged 3082 pounds for the four-sack concrete and 1220 pounds for the three-sack concrete.

The ninety-day compression tests averaged 3532 pounds for the four-sack concrete and 1700 pounds for the three-sack concrete.

The seven-day beam tests averaged 506 pounds for the four-sack concrete and 348 pounds for the three-sack concrete. The fourteen-day beam tests averaged 576 pounds for the four-sack concrete and 382 pounds for the three-sack concrete.

In Contract 010TC5, Road X-Mer-4-A, Merced to six miles southerly, was included 403 cubic yards of three-sack concrete in a 5-inch base course for a 2-inch asphalt concrete surface. The average twenty-eight-day compression test of the three-sack concrete on this project was 1230 pounds per square inch.

The greater part of the work constructed last season was finished with the new type mechanical drag finisher, which has given such excellent results. The average roughness for the seventeen projects finished in this manner was 6.9 inches per mile, and for the five projects finished in the ordinary manner, the average was 13.5 inches per mile.

Cotton mats were used to cure some 27.5 miles of concrete pavements during the 1938 season.

CONSTRUCTION RECORDS

The maximum *average daily output* for portland cement concrete pavement per 8-hour day was placed on Contract 07XC13-87XC34, Road VII-LA-158-LA, from San Fernando Road to Brand Boulevard, by Matich Brothers, 461.2 cubic yards being produced per day. C. N. Ainley was resident engineer, with J. F. Mulgrew as street assistant. The average daily output for the entire State was 408 cubic yards during 1938, as compared to 396 cubic yards in 1937.

The *average compressive strength* at 28 days for Class "A" concrete pavement was 4760 pounds per square inch in 1938, as compared to 4470 pounds in 1937, and for Class "B" concrete pavement an average strength of 3890 pounds was obtained in 1938, as compared to 3417 pounds in 1937.

During 1938 the highest average strength for Class "A" concrete pavement was 5667 pounds, obtained on Contract 05TC1, Road V-Mon-2-D, Soledad Bridge approaches, Granite Construction Company, contractor; F. C. Weigel, resident engineer; and S. N. Isham, street assistant. The strongest Class "B" concrete pavement averaged 4706 pounds on Contract 03TC5, Road III-Pla-17-A, Roe., 0.6 mile east of Roseville to Rocklin, Fredericksen & Westbrook, contractor; W. G. Remington, resident engineer; and R. J. Mehren, street assistant.

The record for *cement control* was made on Contract 07XC7-87XC32, Road VII-Ven-138-A, LaCross to Oakview, the average variation being 0.14 per cent.

J. E. Haddock and Crow Bros. were contractors; W. I. Temple-

PORTLAND CEMENT CONCRETE PAVEMENT RECORDS FOR 1938

Location	Contractor	Resident Engineer	Street Assistant	Average cu. yds. laid per 8-hr. day	Average strength, 28 days, lbs. per sq. in.	Per cent average daily variation in cement	Roughness index, inches per mile
At Red Bluff.....	N. M. Ball Sons.....	F. N. Drinkall.....	A. A. Bigelow.....	183.5	4762	1.59	22.6
0.6 mi. E. of Roseville—Rocklin.....	Fredericksen & Westbrook.....	W. G. Remington.....	R. J. Mehren.....	444.7	4706	0.65	5.0
Ignacio—San Rafael.....	A. G. Raisch.....	W. A. Rice.....	L. J. Stephenson.....	377.0	3480	2.04	13.3
Salinas River Bridge approaches—Soledad.....	Granite Construction Co.	F. C. Weigel.....	S. N. Isham.....	247.3	5667	0.45	6.5
Easterly boundary—1 mi. N. of Rincon Creek.....	C. O. Sparks & Mundo Eng. Co.	J. C. Adams.....	F. C. Weigel.....	197.3	4207	1.30	9.1
Trancas Beach—Walnut Canyon.....	Macco Construction Co.	C. N. Ainley.....	H. D. Johnson.....	441.0	4604	0.48	8.2
Encinal Canyon—Trancas Beach.....	Macco Construction Co.	C. N. Ainley.....	H. D. Johnson.....	436.2	4865	0.43	8.8
At Big Sycamore Canyon.....	Macco Construction Co.	F. A. Read.....	H. D. Johnson.....	419.0	5084	0.78	8.3
Philadelphia Street—Painter Avenue.....	Geo. R. Curtis Co.	W. J. Calvin.....	J. R. Rubey.....	323.7	4281	0.93	13.2
0.4 mi. E.—0.8 mi. E. of Huntington Beach.....	Griffith Company.....	C. L. Gildersleeve.....	H. D. Johnson.....	288.7	4450	0.78	6.1
LaCross—Oakview.....	J. E. Haddock & Crow Bros.	W. I. Templeton.....	H. D. Johnson.....	447.7	3830	0.14	7.6
Orange—Olive.....	Vido Kovacevich.....	F. B. Cressy.....	C. J. McCullough.....	297.6	3082	0.99	6.0
Valley Boulevard—Las Tunas Drive.....	J. E. Haddock, Ltd.	R. J. Hatfield.....	H. D. Johnson.....	398.6	4587	0.44	4.0
Fair Oaks Av., S. Pas.—Glenarm St., Pas.	J. E. Haddock, Ltd.	R. J. Hatfield.....	C. J. McCullough.....	380.3	4865	1.55	7.2
Sepulveda Blvd., San Fernando Rd.—Brand Blvd.	Match Bros.	C. N. Ainley.....	J. F. Mulgrew.....	461.2	4439	0.40	9.0
L. A. County Line—Colton.....	Match Bros.	C. V. Kane.....	Warren Ford.....	455.4	3623	0.53	5.1
New Avenue, Redlands—Crystal Springs.....	Claude Fisher Co.	E. A. Bannister.....	B. Nelson.....	440.0	3955	0.32	11.3
Jahant Corner—1 mi. N. of Galt.....	Fredericksen & Westbrook.....	A. K. Nulty.....	F. L. Lucas.....	451.9	3760	0.52	6.1
Modesto—Salida.....	Fredericksen & Westbrook.....	R. H. Lapp.....	J. C. Witherell.....	455.0	4098	0.51	5.1
6 mi. S. of Merced—Merced.....	Hanrahan Company.....	G. R. Hubbard.....	H. S. Marshall.....	436.6	3619	0.83	4.8
San Onofre—Northerly County Line.....	B. G. Carroll.....	F. D. Pearce.....	L. B. Munro.....	326.0	4390	0.20	8.8
Barnett Avenue—Miramar Road.....	David H. Ryan.....	F. D. Pearce.....	G. S. Kibby.....	388.0	4061	1.50	17.4
				4760 (A)			
				Averages.....	408.0	3890 (B)	0.72 7.8

ASPHALT CONCRETE PAVEMENT RECORDS FOR 1938

Location	Contractor	Resident Engineer	Street Assistant	Average tonnage laid per day	Average stability of surface mixture in per cent	Average relative Gravity of surface mixture in per cent	Roughness index, inches per mile
Delevan—Logandale.....	Hanrahan Company.....	H. O. Ragan.....	H. A. Towne.....	1048.0	24.0	92.0	14.5
Coyote—Llagas Creek.....	Jones & King.....	H. S. Payson.....	P. M. Morrill.....	1037.0	37.1	91.9	12.9
Ignacio—San Rafael.....	A. G. Raisch.....	W. A. Rice.....	L. J. Stephenson.....	387.0	29.3	92.6	23.2
Hanford—Alcorn Bridge Corner.....	Piazza & Huntley.....	J. R. Hayes (County).....	P. A. Boulton.....	689.0	44.5	92.3	14.6
At Selma.....	Union Paving Co.	F. W. Howard.....	E. Thomas.....	510.0	35.0	92.8	9.8
1 mi. N. of Grapevine Sta.—10 mi. S. of Bakersfield.....	Griffith Company.....	D. G. Evans.....	W. M. Nett.....	578.0	34.0	93.3	13.3
Tustin Avenue at 17th Street.....	C. O. Sparks & Mundo Eng. Co.	F. B. Cressy.....	H. B. Lindley.....	382.3	47.0	90.0	11.0
Pasadena Ave.—Avenue 22.....	Bebek & Brkich.....	E. A. Parker.....	L. F. Phillips.....	349.0	32.4	93.7	17.6
Fair Oaks Ave., S. Pas.—Glenarm St., Pas.	J. E. Haddock.....	R. J. Hatfield.....	W. C. Winkler.....	577.3	28.8	93.5	13.1
Sepulveda Blvd., San Fernando Rd.—Brand Blvd.	Match Bros.	C. N. Ainley.....	J. F. Mulgrew.....	369.0	41.0	94.0	26.5
Intersection Firestone Blvd. and Santa Fe Ave.	Griffith Company.....	C. P. Montgomery.....	J. R. Rubey.....	255.0	35.0	95.7	14.6
West. Bndry.—San Bernardino (widening).....	United Concrete Pipe Corp.	J. M. Hollister.....	J. A. Hutchinson.....	673.0	40.4	95.5	19.0
Los Angeles County Line—Colton.....	Match Bros.	C. V. Kane.....	W. Ford.....	707.0	28.0	96.7	13.4
Barnett Avenue—Miramar Road.....	David H. Ryan.....	F. D. Pearce.....	E. C. Dodson.....	660.0	27.0	94.2	16.4
				Averages.....	660.0	35.4 93.5	15.3

ton, resident engineer; and H. D. Johnson, street assistant.

The average variation for the State during 1938 was 0.72 per cent, as compared to 0.81 per cent for the year 1937.

The record for surface smoothness was made on Contract 07XC6-87XC30, Road VII-LA-168-C, Valley Boulevard to Las Tunas Drive, with

an average of 4.0 inches of roughness per mile.

J. E. Haddock, Ltd., was the contractor; R. J. Hatfield, resident engineer; and H. D. Johnson, street assistant.

The average for the State in 1938 was 7.8 inches per mile, as compared to 8.2 inches per mile for the year 1937.

Asphalt Concrete

CONSTRUCTION METHODS

One entire project in 1938 was constructed with asphalt of a penetration ranging from 101 to 120 and consisted of 19 miles of 22-foot pavement on

BITUMINOUS TREATED SURFACES, RECORDS FOR 1398

Plant-mix

Location	Contractor	Resident Engineer	Roughness Index Inches per mile
At Greenlaw Bluffs	Harold Smith	W. H. Chase	38.4
Southerly Boundary—Hopland	Hanrahan Company	C. M. Butts	26.9
Stegemeyer Bluffs—Myers	Hemstreet & Bell	H. M. Hansen	29.6
Nubleber—8.5 mi. NE. of Bieber	Poulos & McEwen	H. K. Ward	19.4
Coppervale—Susan River	Mountain Construction Co.	C. A. Potter	30.2
1½ mi. W. of El Dorado—Clark's Corner	Hemstreet & Bell	H. F. Sherwood	25.0
Tarke—1 mi. S. of Sutter City	Hemstreet & Bell	W. G. Remington	22.8
Mountain House—Contra Costa County Line	Geo. French, Jr.	E. W. Brackett	46.8
1.5 mi.—3.9 mi. SW. of Sebastopol	Embleton-Schumacher	E. Carlstad	75.3
Ignacio—San Rafael (por.)	A. G. Raisch	W. A. Rice	32.7
San Luis Obispo Creek—Cuesta Siding	Metropolitan Construction Co.	V. E. Pearson	18.1
Guadalupe—Santa Maria	Basich Bros.	H. J. Doggart	30.3
1.8 mi. W. of Merryman—Yokohi	N. M. Ball Sons	C. F. Oliphant	40.5
Morton St.—Mulberry St., Porterville	N. M. Ball Sons	C. F. Oliphant	50.6
Trancas Beach—Walnut Canyon	Macco Construction Co.	C. H. Ainley	15.2
Trancas Beach—Encinal Canyon	Macco Construction Co.	C. H. Ainley	13.9
Near Oso Creek	C. O. Sparks & Mundo Eng. Co.	W. D. Eaton	18.0
Near Galivan	V. R. Dennis Const. Co.	W. D. Eaton	17.1
Valley Blvd.—Las Tunas Drive	J. E. Haddock	R. J. Hatfield	10.6
190th St.—Lomita Boulevard	Griffith Company	F. B. Cressy	14.3
Sepulveda Blvd., San Fernando Road—Brand Blvd.	Matich Brothers	C. N. Ainley	27.5
Fair Oaks Ave., S. Pas.—Glenarm St., Pas.	J. E. Haddock, Ltd.	R. J. Hatfield	12.2
Route 60—½ mile northerly	State Forces	L. R. McNeely	26.8
2 mi. S. of San Bernardino County Line—Beaumont	Oswald Bros.	E. A. Bannister	17.1
Through Mojave	S. A. Cummings	M. W. Ellis	20.2
Diaz Lake—Alabama Gates	Basich Bros.	J. N. Stanley	12.0
Southerly Boundary—5 mi. N. of Rosamond	G. W. Ellis	F. R. Pracht	9.2
2.5 mi. E. of Valley Springs—San Andreas	Piazza & Huntley	R. J. Munro	19.2
Douglas St., Eagle St.—University Ave.	V. R. Dennis Co.	C. R. Hagberg	15.8
1 mi. S. of San Onofre—North County Line	B. G. Carroll	F. D. Pearce	16.7
Brawley—Mulberry Avenue	R. E. Hazard & Sons	R. C. Payne	12.2
Holtville—Brawley	G. W. Ellis	C. R. Hagberg	24.9
On E. Main St., 5th St., 6th St.	G. W. Ellis	W. T. Rhodes	25.4
Average			23.5

Road-mix

Location	Contractor	Resident Engineer	Roughness Index Inches per mile
Spanish Creek—Quincy	Harms Bros.	R. L. Gerry	38.2
Route 28, 1.0 mi. NE. of Bieber—2.5 mi. N.	Poulos & McEwen	H. K. Ward	20.4
At China Gulch	Lee J. Immel	J. C. Young	31.0
Cougar—Maddox	Oilfields Trucking Co.	R. E. Ward	26.1
7.0 mi. W.—10.5 mi. W. of Willows	Lee J. Immel	P. C. Sheridan	103.0
3 mi. N. of Esparto—NE. Cor. of Rancho Guesisosi	Claude C. Wood	H. C. Looze	62.2
Mountain House—Greenville	Granfield, Farrar & Carlin	L. G. Marshall	20.2
Atascadero Summit San Gabriel Ave.	Geo. K. Thompson & Co.	H. J. Doggart	32.4
Los Olivos	Macco Construction Co.	A. L. Lamb	45.6
Paicines—Tres Pinos	N. M. Ball Sons	F. C. Weigel	44.4
Lake Arrowhead Dam—Junction Route 43	State Forces	G. E. Malkson	22.0
At Independence	Basich Bros.	J. N. Stanley	19.3
1.5 mi. W. of Bishop—Bishop	Basich Bros.	M. W. Ellis	19.2
W. City Limits, Bishop—Main St.	Basich Bros.	M. W. Ellis	19.2
S. Fork Mokelumne River—Herbert's Ranch	Garcia Construction Co.	L. E. Ford	131.1
New River—2 mi. W. of Calipatria, 5 mi. W.—2 mi. W. of Brawley	R. E. Hazard & Sons	R. C. Payne	39.9
Average			38.7

Miscellaneous Types

Ben Ali—U. S. Airport	A. Teichert & Son (Armor Coat)	R. E. Vernon	130.5
0.7 mi. N. of Biggs—Route 45	Chas. Kuppinger (Armor Coat)	W. W. Greer	84.9
N. line of Las Uvas Rancho—Croy Road	Bodenhamer Const. Co. (Armor Coat)	H. H. Deardoff	93.4
San Geronimo—1 mi. N. of Fairfax	Granfield, Farrar & Carlin (Armor Coat)	B. Van Dalsam	32.9
Over Welby Hill	Granite Construction Co (Rock Asphalt)	L. L. Lenger	28.1
1.7 mi. E. of Los Banos—Easterly Bdy.	Fredericksen & Westbrook (Armor Coat)	E. W. Ray	28.4
Oakville—Calistoga	Rock & Gravel Trucking Co. (Armor Coat)	R. Engelking	150.7
Average			83.0

Contract 06VC3-86VC4, Road VI-Ker-4-A,B,C, from one mile north of Grapevine Station to ten miles south of Bakersfield, connecting on the north

with the experimental project of 1937. Griffith Company was the contractor; D. G. Evans, resident engineer; and W. M. Nett, street assistant, the same

contractor and State personnel that constructed the adjoining experimental section in 1937. The technique for laying high penetration mixtures

on this project was worked out under the direction of Mr. Evans. Variations in the grading of aggregate were tried out on this project with the object of improving stability and surface texture. It was found that a reduction in added commercial filler to 3 per cent and a passing 10-mesh content of 28 per cent, considerably improved the stability results and gave a surface texture much more desirable than the average grading of a Type "A" surface mixture and at the same time was impermeable with the softer grade of asphalt. The same relative amount of asphalt to the

coarse and fine aggregate was maintained in all of the mixtures.

Automatic proportioning has become standard procedure for all major asphalt concrete projects, and all of the 1938 contracts with any sizeable tonnage employed this method. Automatic proportioning equipment has been perfected to such accuracy that errors in the payment weights over truck scales have been detected and corrections made upon comparing the weights obtained by the two methods. The average daily output has been materially increased from plants

equipped with automatic proportioning.

The amount of asphalt used in the mixture continues to be varied on the basis of the particular characteristics of the binder being used, and since this practice was put into effect, the uniformity of performance of the various projects has been greatly improved. It is the present tendency to use as much asphalt as is possible, compatible with stability results. In so far as is evident at the present time, the same relative amount of the higher penetration asphalt is required as was used of the 40-60 penetration.

CONSTRUCTION RECORDS

The highest average daily output of asphalt pavement tonnage since 1932 was placed on Contract 03TC2, Road III-Col. GL-7-C,A, between Delevan and Logandale, where 1048 tons were placed by Haurahan Company, contractor; H. O. Ragan was resident engineer; and H. A. Towne, street assistant. Another project averaging in excess of 1,000 tons per day was Contract 04TC5, Road IV-SC1-2-B,C,MgH, between Coyote and Llagas Creek, where Jones & King, contractor, placed an average of 1037 tons per day. H. S. Payson was resident engineer and P. M. Morrill, street assistant. The average daily output for the State in 1938 was 660 tons, as compared to 550 tons in 1937.

The highest stability of surface mixture was obtained on Contract 07XC5, Road VII-Ora-43-A, between Tustin Avenue and 17th Street, where the average was 47 per cent. Sparks & Mundo Engineering Company was the contractor; F. B. Cressy, resident engineer; and H. B. Lindley, street assistant. The average stability for the State was 35.4 per cent in 1938, as compared to 36 per cent in 1937.

The densest surface mixture was placed on Contract 08XC1, Road VIII-SBd-26-C,D,Ria,Col, between Los Angeles County Line and Colton, where the average relative specific gravity was 96.7 per cent. Matich Bros. was the contractor; C. V. Kane, resident engineer; and W. Ford, street assistant. The average for the State in 1938 was 93.5 per cent, as compared to 94.6 per cent in 1937.

The record for surface smoothness was secured on Contract 06TC1, Road VI-Fre-4-A,Sel, at Selma, on which the average was 9.8 inches per mile. The contractor was the Union Paving Company; F. W. Howard was resident engineer; and E. Thomas, street



Coast Highway near Big Sycamore Canyon, Ventura County. Two 22-foot portland cement concrete pavement lanes separated by a 6-foot plant-mix center strip.



Divided four-lane highway on Coast Route at Trancas Beach, Ventura County, consisting of an 11-foot interior lane of plant-mixed surfacing and a 12-foot lane of concrete on each side of a 4-foot planted and curbed division strip.

assistant. The average for the State in 1938 was 15.3 inches per mile, as compared to 15.5 inches in 1937.

Bituminous Treated Surfaces

The plant-mix type maintains the lead in mileage placed in 1938, with a total of 116.5 miles, as compared to 92 miles of road-mix.

Traveling mixers performed nearly all of the road-mixing during 1938. The efficiency of mixing with these machines has on the whole been excellent. The road-mix method of construction does not permit the accuracy of oil control or the uniformity of grading of the aggregate, as compared to plant-mix, but it does have a definite place in construction of secondary highways.

The tendency toward the use of plant- and road-mixes on major high-

ways as stage construction, is becoming more pronounced from year to year. This type of construction has in many similar locations given remarkable service in the past.

About 26.5 miles of armor coat oil surfacing was constructed in 1938 under supervision of the Construction Department, and a one-mile project of native-rock asphalt.

The record for surface smoothness of plant-mix, 9.2 inches per mile, was made on Contract 09VC4, Road IX-Ker-23-A, between Southerly Boundary and 5 miles north of Rosamond. G. W. Ellis was the contractor and F. R. Pracht, the resident engineer. The average for the State was 23.5 inches per mile in 1938, as compared to 28.6 inches in 1937.

The record for surface smoothness of road-mix, 19.2 inches per mile, was duplicated on two adjoining projects, Contracts 09XXC4 and 09XXC6, Roads IX-Iny-76-B,Bis and IX-Iny-76-Bis, from 1.5 miles west of Bishop

to Bishop and from West City Limits of Bishop to Main Street. Basich Bros. was the contractor on both projects and M. W. Ellis was resident engineer. The average for the State in 1938 was 38.7 inches per mile, as compared to 31.6 inches in 1937.

The record for surface smoothness of armor coat work, 28.4 inches per mile, was made on Contract 010WC3-610WC9, Road X-Mer-32-C, between 1.7 miles east of Los Banos and Easterly Boundary. Fredericksen and Westbrook was the contractor and E. W. Ray, resident engineer. This record is considered exceptional for armor coat work.

The native-rock asphalt project gave an average smoothness of 28.1 inches per mile and was constructed under Contract 05TC2-85TC5, Road V-Mon-2-F, over Welby Hill, by Granite Construction Company, contractor, with L. L. Lenger, resident engineer.

Proposed Transcontinental Toll Highways Opposed by U. S.

TRANSCONTINENTAL toll superhighways are neither needed nor are they feasible at this time, U. S. Bureau of Public Roads officials declare. Views of the federal road experts are revealed in recent statements of Thomas H. MacDonald, chief of the bureau, and of H. S. Fairbank,

chief of the Bureau's Division of Information.

Testifying before a House subcommittee on appropriations, Mr. MacDonald said, "We definitely recommend against a system of transcontinental toll highways. Our position is, as we have been convinced through

the years, that highways should first be developed to take care of local traffic. Our long distance highways should be extensions of these local roads.

"Transcontinental superhighways to be constructed and maintained by tolls have been proved illogical."

New Divided Approach to City of Merced Solves Flood Problem

By R. E. PIERCE, District Engineer

ANOTHER unit of four-lane divided highway on U. S. 99, Golden State Highway, has been completed, extending for 5.7 miles southeasterly from Merced.

Due to a series of wet winters and changed conditions caused by irrigation ditches and other factors, the highways in the vicinity of Merced have been flooded for four consecutive winters, beginning with 1935. This recurrent flooding and the inconvenience and hazard to the traveling public has been the cause of much concern.

U. S. 99 was the most immediate problem, carrying as it does a heavy local and through traffic, which was seriously inconvenienced, due to the depth of the flood waters, making it

necessary to detour traffic many miles out of direction for considerable periods.

HIGHER GRADE BUILT

Thought was first given to raising the grade of the existing road and enlarging the drainage structures. However, the volume of traffic indicated the necessity of additional traffic lanes, and plans were therefore made for an entirely new grade adjacent to and northeasterly from the old road, built high enough to clear the highest observed flood, and with drainage structures generally equaling the size of those through the Southern Pacific railroad grade which is adjacent to, parallel with, and to the southwest of the old road.

It was also considered necessary to construct some new drainage structures in the old road opposite those on the new road in order to allow for free passage of flood waters and avoid damage to the old road.

Due to lack of finances, it was impossible to eliminate all the flooded stretches; so the first project was planned to care for the worst portion, extending from Merced southeasterly for 5.7 miles.

The project now completed will be, in effect, a four-way divided highway most of the time. During extreme floods, there may be periods of a few days when the old road will be closed, and traffic will use the new high grade as a two-way road, until the flood waters subside.



View of new Merced highway, on right, showing its elevation to escape flood waters. Old highway on left.



Another view of Merced highway, showing difference in grade between new road, right, and old road, left.

The work, in general, on this project consisted of widening the existing roadbed and building a new roadbed above the flood plane; constructing portland cement concrete pavement; placing asphalt concrete surface course on a short section with portland cement concrete base; placing plant-mixed surfacing and untreated crushed gravel or stone surfacing; constructing borders of untreated crushed gravel or stone surfacing adjacent to the newly constructed pavements, and placing asphalt concrete transitions from the new pavement to the existing pavement.

Reinforced concrete bridges were constructed on both the new and old roads. Penetration oil treatment was applied to borders, shoulders, and road approaches, and many other minor items of work were done.

There is, in general, a 21-foot horizontal separation between the old and the new pavements, with cross-overs between the two pavements limited to county roads.

IMPROVED DRAINAGE

Under agreement with the Southern Pacific Company, improvements were made in the drainage between the

highway and the railroad, by means of ditches and levees which to some extent will prevent the flooding of the old road during moderate flood runoff.

Portland cement concrete curb islands at the south and north ends of the project are used to aid in traffic channelization. These islands are lighted with mercury vapor 250-watt lights. Standard reflectors and flashers are installed in the face of the curbs.

Native soil being of adverse nature, it was necessary to import satisfactory material for subbase and subgrade.

The improvement consisted generally of constructing a graded roadbed 36 feet wide with Class "B" portland cement concrete pavement 23 feet wide and .55 feet thick with thickened edges in the outer 2 feet and providing for 11-foot and 12-foot traffic lanes. Crushed gravel borders 2 by 5 feet, after compaction, are built on each side of the pavement.

Imported borrow with a minimum thickness of 1 foot at center line has been placed throughout the entire length of the project. Shoulders and slopes are oil treated. At the ap-

proach to the city of Merced, the pavement is asphaltic concrete with all other details the same as the portland cement concrete pavement.

ITEMS OF CONSTRUCTION

The construction provided for: three new bridges on both the new and old roads, six new bridges on the new road only, one bridge on the old road lengthened, four reinforced concrete culverts on both new and old roads, two reinforced concrete culverts on the new road only, one reinforced concrete culvert on the old road increased in size, and four irrigation siphons extended across the new road.

With the exception of imported borrow, all road materials were commercial products.

The major construction items and approximate quantities are as follows:

Imported borrow	145,000 cu. yds.
Reinforcing steel	617,000 lbs.
Class "A" portland cement concrete (strs.)	2,650 cu. yds.
Class "B" portland cement concrete (pvmt.)	12,600 cu. yds.
Asphaltic concrete	3,600 tons
Untreated crushed gravel or stone	10,000 tons
Pavement dowels and or tie bolt assemblies	24,000 each

The finished work cost approximately \$355,000.

Restoring Cajon Pass Highway

By A. EVERETT SMITH, Assistant Highway Engineer

CONSTRUCTION work is progressing on portions of State Highway between Devore and Camp Cajon. This is a link common to both the National Old Trails Highway and the Arrowhead Trail Highway. It leads over mountainous terrain and through the Cajon Pass.

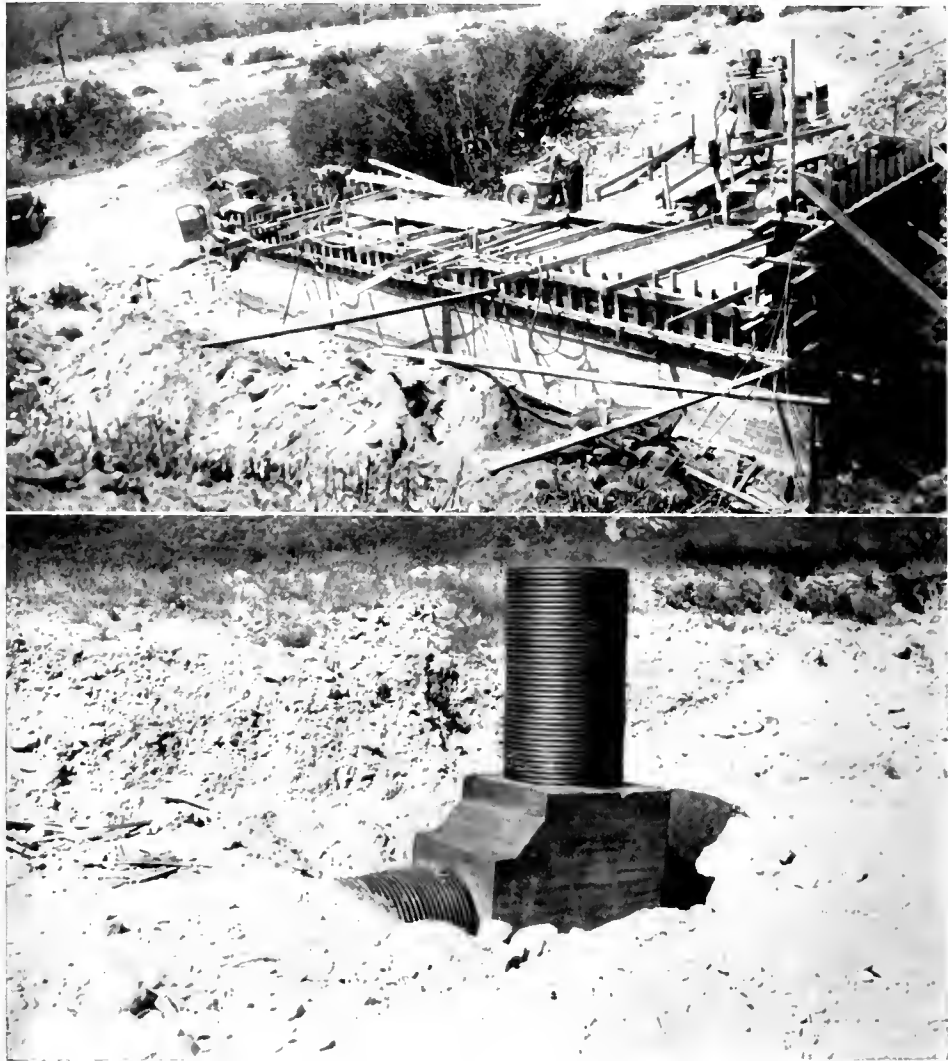
The work was made necessary by the flood of March, 1938, and is of a restoration nature.

During the flood period high velocity runoff water from the adjacent mountains carried great quantities of sand, gravel and boulders. In numerous cases this material was deposited in stream channels above drainage structures, raising the streambed above the structures.

An accompanying picture shows a chimney type inlet designed to admit drainage to a culvert. The top of the chimney is at the approximate new elevation of the streambed.

At a location known as the Blue Cut the flood waters raised the bed of Cajon Creek and washed out the portion of the roadway that was in embankment. To prevent a recurrence, the roadway alignment was shifted farther into the hill so that the entire roadway will be in a cut section of rocky material.

Other work in connection with this project involved minor line changes, correction of and placing new drainage structures and constructing metal cribbing retaining walls. At some locations, ditches and dikes are designed to control drainage runoff. Plant-mixed surfacing is to be placed throughout the project, to conform to the existing road.



Top—Reinforced concrete box culvert being constructed where Cajon Pass highway is on new alignment. Bottom—Chimney type inlet to corrugated metal pipe culvert on new Cajon Pass highway.

Awards to Contractors for Roadside Development Projects Planned

IN ORDER to stimulate interest among highway contractors in roadside-development projects along State highways throughout the country, *Contractors and Engineers Monthly* announces the first of a series of annual awards to contractors or their superintendents for excellence of execution of roadside-develop-

ments, or for the best suggestions for more effective methods to achieve better results or greater economies on such projects.

An award of an engrossed certificate will be made in each of the four geographical sections, East, South, Central and West, and one of the winners in one of these sections will

receive the national award of an engraved trophy as evidence of his outstanding contribution to better roadsides in the United States.

Nominations for the awards will be made by State highway departments in each State and must be submitted before September 15. Each State will

(Continued on page 26)

Benefits of Gas Tax Expenditures Within Cities Are Enumerated

By L. V. CAMPBELL, Engineer of City and Cooperative Projects

Following is the text of an address delivered by L. V. Campbell, Engineer of City and Cooperative Projects of the Division of Highways before the Monterey Bay Area Division of the League of California Municipalities meeting at Salinas, June 14, 1939.

THE allocation of a specified amount of gas tax revenue for expenditure within cities has been in effect almost six years. Originally, the expenditure was limited to the designated State highway routes within cities. Two years later the act was amended to increase the amount and extend the use of the funds to streets of major importance other than State highways as may be agreed upon between the city and the State Department of Public Works. Prior to this time expenditures of gas tax funds by the State within cities were budgeted for specific projects by the Highway Commission. Projects were generally selected in those municipalities which cooperated financially in the improvement, except in the case of the lesser populated cities. As a consequence many urgently needed projects within cities had to be omitted due to lack of financial cooperation, and expenditures were not uniformly distributed among the cities.

The amounts thus budgeted by the Commission for expenditure in cities would average close to the amount derived from $\frac{1}{4}$ cent of gas tax revenue. It must be remembered that of the three-cent State gas tax, two cents were expended by the State and one cent was apportioned to the counties for expenditure by the supervisors upon county roads. At that time the State expenditure both in municipalities and rural areas, was limited by statute to those roads which were officially designated as State highways. There was no specific mandate in the law requiring the department to extend the State highways into or through municipalities, and as a

consequence, the Highway Commission generally halted the State highway at the corporate limits.

Six years ago, however, brought a different, more comprehensive and surely a more equitable view of the situation. This view contemplates a State highway system, not as a disjointed system of roads terminating at the corporate limits, but as a system

upon himself to find his way through the city. This he found in many cases, however, was the preferred procedure, for when the route was marked by signs he followed the course decided upon by local influence and frequently meandered by devious ways with many turns past the town's commercial enterprises, parks, fountains and streets.

Such conditions, however, with the aid of the $\frac{1}{4}$ cent gas tax and the splendid cooperation of the cities, have been or rapidly are being corrected. State highways leading into and through municipalities have been selected and adopted following the most expeditious routes through each city in the State. These routes are marked with mileage and directional signs and in many cases with State route markers and U. S. route shields with which all motorists are acquainted and which serve to guide the motorist through the complexities of strange cities.

The allocation of gas tax revenue to cities, as all of you well know, provides one quarter cent for expenditure upon State highway routes within cities and one quarter cent for expenditure upon streets of major importance within cities other than State highways. Of the 285 incorporated cities in California, the State highway passes into or through 253 of them. The remaining 32 cities may expend the $\frac{1}{4}$ cent allocated for State highways upon streets of major importance.

Furthermore, when all State highways within a city are improved to adequate standards and provision made for their maintenance, any surplus of the quarter cent allocated for State highways may likewise



L. V. CAMPBELL

that should provide a continuous route improved to State highway standards through the city. Heretofore the motorist found himself, you might say, deserted at the city limits and confronted with the difficult problem of navigating his passage through a city which for many reasons did not possess the resources to provide an adequate standard of street improvements. Besides this condition, the motorist was compelled to depend



These two views vividly show what the City of San Diego was able to do with 1½ cent city street gasoline tax funds. The picture at the top shows the site of the Douglass Street extension before construction. The one at the bottom shows the extension after completion. Both photographs were taken from the same spot. The slope at the left of the house in the upper picture was filled in to make the grade shown in the picture below.

be expended upon streets of major importance.

One quarter cent of gas tax revenue will yield in round figures four million dollars per year. Thus, under the gas tax allocation there are four million dollars per year expended upon State highway routes within cities and another four million dollars

per year expended upon city streets other than those constituting the designated State highway routes within cities. This makes a total of eight million dollars expended annually upon the State highways and other streets of major importance within cities.

When it is realized that seventy-five

per cent of the people living in California reside in incorporated cities, it is readily seen that the benefit of the expenditure of the gas tax funds within cities is brought to the front door of a large block of the State's population. What this means to the urban taxpayer may be better understood when it is realized that this

amount of money represents a tax rate of 16.86 cents per one hundred dollars of assessed valuation within cities. From data contained in the annual report of financial transactions of municipalities and counties, published by the State Controller, I have calculated that the average tax rate of all cities within the State amounts to \$1.915 per one hundred dollars of assessed valuation.

According to the State Controller's report above mentioned, the total expenditure by municipalities during the fiscal year ending 1937 upon highways, roads, and streets within municipalities, in round figures amounted to \$20,746,000. This figure is analyzed as follows: General administration, \$2,780,000; maintenance of streets, bridges, etc., \$10,583,000; prevention of street dust, \$225,000; street lighting, \$3,343,000; other street structures \$582,000; outlays, \$3,233,000. Excluding the cost of street lighting, the net amount expended upon streets and roads attributable as a direct benefit to vehicular traffic amounts to \$17,403,000. The cost of street lighting is excluded from the total for purposes of comparison, since the use of gas tax funds for street lighting is prohibited by law. Furthermore, the figure for street lighting heretofore mentioned, undoubtedly does not represent the total expenditure for that purpose. There are numerous special assessment districts for street lighting

within cities. Expenditures of proceeds from special assessments are reported as "Special Assessment Expenditures," and are not segregated and reported under the classification to which the expenditure belongs, making it impossible to ascertain the total amount expended for street lighting. The eight million dollars per year of the gasoline tax expended upon State highways and city streets within municipalities amounts to nearly one half the total expenditure by cities for street and highway purposes exclusive of the cost of street lighting. This figure includes only the gas tax allocation required by law, and does not take into consideration any gas tax money the Highway Commission may budget for State highways in cities in addition to the two quarter cent allocations, nor of any Federal aid or Federal grade separation funds available to the Highway Commission which may be apportioned for expenditure within cities. If any such additional amounts were included with the gas tax expenditures within cities the ratio would be increased; and the Highway Commission has continued to budget additional gas tax funds in increasing amounts for the improvement of State highway routes within cities.

The act provides that each city shall prepare a budget of proposed expenditures of the $\frac{1}{4}$ cent for streets of major importance to be made dur-

ing the ensuing fiscal year. There is little discretion left to the department in the approval or disapproval of the budget, other than to see that the proposed expenditures are in accordance with the provisions of the act. The act does not require the department to consult with cities in the expenditure of the quarter cent allocation for State highways. Nevertheless, at the time the allocation of gas tax funds for expenditure upon State highways within cities was first enacted in 1933, the department as a matter of policy turned over to the cities the preparation of the budget or program for the expenditure of the money. The wisdom of such a policy has been fully demonstrated. During the past six years, the many difficulties attendant upon the inauguration of a procedure for the expenditure of this money, have been ironed out and there has developed a cooperation between the cities and the department based upon mutual confidence and respect.

In accordance with the provisions of law, the gas tax allocation to cities is expended by the State department of public works or is delegated to the city for expenditure. Work conducted by the department is performed by State forces or by contract under the direct supervision of the Division of Highways. Arrangements are made whereby the expenditure of the gas tax is delegated to the city where it is equipped to conduct the



This is Cliff Drive in the City of Santa Barbara, which was paved with Santa Barbara's allocation of $\frac{1}{4}$ cent gas tax moneys for streets.



This picture shows a fine example of what cities can do with their $\frac{1}{2}$ cent gas tax funds. It was taken in Monterey. The old dirt road on the right followed a route to the right of the line of white posts. It was replaced by the modern paved alignment shown on the left.

particular work contemplated in an efficient and economical manner. This delegation is compulsory upon the department in the case of the quarter cent allocation for expenditure upon streets of major importance, and has been followed as a matter of policy in the expenditure of the allocation for State highways, since its enactment in 1933. In determining whether a city is properly equipped to perform the work, the department will leave that to the city to decide.

Aside from the mandatory provisions of the act, the department

prefers, and sincerely urges the cities themselves to expend the gas tax revenue allocated to cities. This applies with equal force to expenditure on State highways as well as on streets of major importance. As so frequently happens, the work within a city should be performed at a particular time of year in order to take advantage of the most favorable weather conditions or to avoid having the streets torn up during some celebration or convention. That is usually the time when work on the rural State highways is at its peak. Unless the

city is doing its own work the result is obvious and the work within the city is apt to suffer delay. With the city responsible for the work, the schedule of operations can be arranged to best fit in with local conditions, and there is better satisfaction all around. Those cities which do not have a full time city engineer may retain a consulting engineer to prepare plans, specifications and supervise the work.

The cost of such services are a proper charge against the gas tax funds.

Thomas A. Bedford Retires from State Highway Service

WITH a record of seniority dating back to 1911, Thomas A. Bedford, veteran engineer of the State Division of Highways, retired from active service on July 15.

Graduating from the Southwest University of Georgetown, Texas, in 1891, Mr. Bedford for ten years was a private engineer and county engineer of Knox County, Texas. Thereafter, for seven years he was division engineer of the Kansas City, Mexico and Orient Railway in Old Mexico. He turned to highway engineering when he became principal assistant to A. B. Fletcher, Chief Engineer for the San Diego County Highway Commission, in 1908. He served in this capacity until 1911.

When Mr. Fletcher became Chief



T. A. BEDFORD

Engineer of the State Division of Highways, Mr. Bedford was appointed Division Engineer in District II on December 9, 1911. Later he transferred to District I. In 1928 he took a year's leave of absence to serve as assistant general manager for the Kaiser Construction Company in Cuba. He returned to State service in 1929, since which time he has been on duty in the Surveys and Plans Department of the Division of Highways in central office in Sacramento.

Mr. Bedford was tendered a farewell dinner by his associates in the Division of Highways on June 29 and then departed on a vacation at the end of which he plans to travel extensively in Canada and throughout the United States to make a personal study of modern highways.

Relocating Southern Pacific Railroad Costs \$17,500,000

(Continued from page 2)

passenger trains and at least twenty-five minutes for freight trains. There will be more grade rise on the new line but maximum gradients of the new and old lines are about the same. It is believed that the new line will be much cheaper to operate than the existing line.

The new railway will be equipped with centralized train control instead of the usual automatic block signals. This method of controlling traffic has recently been developed and under certain conditions varying with each installation, will increase the traffic capacity of a single track line by from

bridge, and two small additional bridges over O'Brien and Salt creeks.

Progress on major construction contracts up to date is as follows:

Sacramento River Bridge at Redding, substructure under contract to Clifford A. Dunn—complete.

Steel erection on superstructure under contract to American Bridge Company—two-thirds complete.

Grading between Sacramento River crossing to Bass Hill, 12½ miles, under contract to Granfield, Farrar & Carlin—75 per cent complete.

Section from Bass Hill Ridge to Pit River under contract to West Construction Company, 1900 feet of tunnel excavated.

Section from O'Brien Creek to second crossing of Sacramento River under contract to R. G. Clifford, 4 miles—work started June 20, 1939.

Section between second and third crossings of Sacramento River, 5 miles, under contract to Granfield, Farrar & Carlin, including 2½ miles of highway relocation—work started on new highway alignment.

Northernmost section, about 1 mile, under contract to United Concrete Pipe and Construction Company—two tunnels about completed and work started on substructure for bridges.

Additional contracts are under way on other bridge crossings.

PIT RIVER BRIDGE NEXT

The last contract expected to be let will be that covering the construction of Pit River bridge. This will be an outstanding structure in many respects. When completed it will be the highest double deck bridge ever built, rising about 500 feet above present stream level, and having a total length of 3590 feet. The main structure will consist of eight truss spans of various heights. The central portion will be a Cantilever structure with 630 foot main opening and 496 foot anchor arms; simple spans will complete the structure at each end. The structure will be supported by concrete piers extending to solid bedrock. The lower deck of the bridge will carry a double track railroad and the upper deck will be used as a highway crossing with a pavement 44 feet wide flanked by walkways 2½ feet wide. This will provide the crossing for the main state highway (Route No. 99) portions of which will also have to be relocated around the reservoir.

WORK UNDER SUPERVISION OF BUREAU OF RECLAMATION

This railroad relocation work is under the general direction of Ralph Lowry, Construction Engineer in charge of the Kennett Division of the Central Valley Project including Shasta dam and appurtenant works, and under the immediate direction of Roy M. Snell.

Walker R. Young, Supervising Engineer of the Central Valley Project, estimates that the new line will be completed and ready for operation by September 1, 1941. In the



RALPH LOWRY
Construction Engineer

50 per cent to 80 per cent. As the relocated line could handle considerably more trains and tonnage in a given time than the existing line, the change in traffic capacity involves postponement of the time when and if double tracking is needed.

CONSTRUCTION PROGRESS

Actual construction of the new railroad was started in October, 1933. Contracts have now been let on all of the work except for the section between the Pit River and O'Brien Summit on which bids will be received on July 14th, the Pit River



ROY M. SNELL
In charge of relocation

meantime a by-pass tunnel has been completed through the right or westerly abutment of Shasta dam to temporarily reroute the existing railroad through the dam site so that excavation and construction of the dam can proceed without interrupting rail traffic. Trains are now running through this tunnel and will continue to use the existing line until the new railroad is completed.

"Honey, as a dancer you are without a peer."

"Don't worry, big boy! I'm going to England to get me one."



Cutting barricade on Los Gatos-Santa Cruz Highway. Left to right—Mayor Vertin, Los Gatos; Supervisor George Ley, Santa Cruz; Supervisor Joseph McKinnon, Santa Clara; Mayor Hinkle, Santa Cruz, holding end of saw; Lieutenant Governor Patterson; Byron N. Scott, Secretary Highway Commission; Director of Public Works Frank W. Clark; Col. Jno. H. Skeggs, District Highway Engineer; Donald Younger, Santa Cruz.

Million-Dollar Highway Opened

WHILE a large throng of jubilant motorists vociferously expressed their satisfaction, officials of the State and of Santa Cruz and Santa Clara counties assembled near the summit of the new road and formally dedicated the million-dollar link of the Los Gatos-Santa Cruz Highway between The Oaks and Inspiration Point on Saturday afternoon, July 1.

Following a program of speeches and a dedicatory address by Director of Public Works Frank W. Clark, the new four-lane highway was declared open to the public by Lieutenant Governor Ellis D. Patterson, representing Governor Culbert L. Olson. At a signal from the Lieutenant Governor, Mayor C. D. Hinkle and Supervisor George Ley of Santa Cruz, and Mayor Marc Vertin of Los Gatos and Supervisor Joseph McKinnon of Santa Clara County, expertly han-

Governor Culbert L. Olson expressed his regret that he could not attend the Los Gatos-Santa Cruz Highway dedication in the following telegram to Donald Younger, chairman of the celebration committee:

"Regret it will be impossible to be with you and the good people of Santa Cruz County for the opening of the Los Gatos-Santa Cruz Highway. Please express my regrets to the people and congratulate them on their accomplishment. Also assure them of this administration's continuing support in all progressive matters."

dling two huge saws, cut through a redwood log barrier and a cavalcade

of waiting automobiles sped over the highway to Santa Cruz, where another celebration was staged, with Lieutenant Governor Patterson and H. R. Judah, former chairman of the California Highway Commission, as the principal speakers. A banquet at the Hotel Palomar on Saturday night brought the day's festivities to a close. Donald Younger was master of ceremonies throughout the afternoon and at the banquet.

During his address Director Clark took occasion to urge that all citizens of California take a greater interest in governmental affairs at Sacramento and keep in closer touch with their legislative representatives on matters of public importance.

Present at the dedication was Col. Jno. H. Skeggs, District Highway Engineer, who supervised the building of the entire Los Gatos-Santa Cruz Highway project, including the

(Continued on page 28)

Highway Funds Inadequate to Meet Present Day Road Demands

SPEAKING at the dedication on July 1 of the completed link of the Los Gatos-Santa Cruz Highway between The Oaks and Inspiration Point, Director of Public Works Frank W. Clark called attention to the inadequacy of funds to meet the highway demands of today. He said:

"The State of California finds itself today in a somewhat difficult position with respect to its nearly fourteen thousand miles of State highways. This State, having been one of the first to undertake the task of providing its citizens and its thousands of visitors with facilities for motor travel, has created for itself a reputation throughout the nation for the quality and extent of its highway system.

"At the present time, we are confronted with an ever-increasing volume of highway usage by individuals who demand not only that this State's highways shall be of a higher standard than they would look for elsewhere but also that these facilities for travel be improved to even higher standards of safety and convenience.

"To meet these demands, however, funds available for the purpose have become increasingly inadequate. This circumstance is illustrated by the fact that for the next two years it is estimated that the total sum available for major construction projects will not exceed \$28,000,000 whereas a conservative estimate of the amounts required at the present time to modernize the existing highway system in accordance with current traffic requirements may be briefly summarized as follows:

For reconstruction, new construction and surfacing.....	\$324,659,500
For widening major arteries to provide divided multi-lane roads.....	76,675,700
For bridges, flood protection and railroad and highway grade separations.....	70,565,000
For freeway construction through congested areas.....	36,000,000
For miscellaneous improvements.....	3,110,000
Total.....	\$511,010,200

"These figures are the result of de-



Director of Public Works Frank W. Clark, delivering dedicatory address at celebration of opening of Los Gatos-Santa Cruz Highway. Seated, left to right—Mayor Hinkle, Santa Cruz; Mayor Vertin, Los Gatos; Lieutenant Governor Patterson.

tailed studies made by the eleven district engineers of the Division of Highways as published in the recently completed report of the California State-wide Planning Survey conducted by the United States Bureau of Public Roads and the California Division of Highways.

"Under the circumstances, therefore, the problem confronting the

California Highway Commission and the Division of Highways becomes not solely one of building roads but of exercising the utmost care in selecting for improvement those portions of the system where the need is demonstrably the most urgent.

"A large number of you no doubt remember the old narrow, twisting

(Continued on page 26)

Storms in California During the Winter 1937-38

(Continued from page 9)

be the case near salt water. Costs vary from 11¢ to 30¢ per square foot, dependent upon thickness. Thicknesses more than 8 inches do not appear to be necessary.

Gunite Facing

Gunite facing 2 inches thick is comparatively light in design and has little resistance to progressive failure when undermined or subjected to the heavy impact of debris.

Grouted Rock Facing and Hand-placed Rock Facing

Grouted rock facing 8 inches to 12 inches thick and hand-placed rock facing of the same thicknesses are light in design and limited to selected locations where rock or cobblestone and labor such as WPA are available. Grouted rock facing is adaptable to 1½:1 slopes. Success of ungrouted hand-placed rock facing is dependent upon a flat slope of not less than 2:1. Costs run from \$2.50 to \$4.50 per cubic yard.

Random Select Bank-run Riprap

Ungraded selected bank-run rock excavation containing excessive fines, where subjected to nominal low-velocity flow, generally proved satisfactory, but when subjected to the higher velocities of streams at flood, particularly at points of stream impingement, failure was extensive almost without exception.

This is the first installment of an article prepared by Mr. G. A. Tilton, Jr., for California Highways and Public Works and Pacific Road Builder and Engineering News. The second installment will appear in the August issue of this magazine.—Editor.

An analysis of pedestrian fatalities in the District of Columbia by American Automobile Association discloses that over an eight-year period an average of 70 per cent of all traffic fatality victims were pedestrians. Sixty per cent of these were killed during hours of dusk or darkness and nine out of ten pedestrians killed who were old enough to operate a motor vehicle were not licensed drivers and not familiar with operating a motor vehicle. Nearly half of the pedestrians killed were 55 years of age or over.

Deserved Praise

State of California

DEPARTMENT OF MOTOR VEHICLES

California Highway Patrol
E. Raymond Cato, Chief
Sacramento, Calif.
Salinas, California.
June 5, 1939.

Lester H. Gibson,
District Engineer,
Division of Highways,
P. O. Box 841,
San Luis Obispo, California.

Dear Mr. Gibson:

I desire to call to your attention the cooperation and assistance rendered by Messrs. Kay Willis, Bob Clinch and Charles Snider, located at the Big Sur Maintenance Station. It was through their untiring efforts and training in first-aid that in the accident of May 23d near Anderson Canyon there was no greater loss of life.

These men were first at the scene of the accident and stayed there until all assistance had been completed. Two of these men were injured when they answered this call, yet their injuries were forgotten in their desire to serve the people of the State of California. It is cooperation and assistance of this nature that brings the various State organizations closer into one unit, giving that assistance to the motoring public which we, as members of Civil Service, strive to render.

I highly commend these men for their loyalty and assistance. Will you please convey the thanks of Officer Williams and myself to these men? It is with gratitude and satisfaction to be able to know that we can depend on these men for further assistance in emergencies of this character.

Very truly yours,

L. T. TORRES,
Captain, San Benito-
Monterey Co.

Highway Funds Inadequate for Road Demands

(Continued from page 25)

roadway replaced by the section being dedicated today. There can be no question in the minds of anyone as to the urgency of the reconstruction of this particular section.

The several earlier projects completed since the reconstruction of this route connecting Santa Cruz and Los Gatos was started in 1932, involved expenditures of \$961,636. This section opened today cost \$1,064,000. There remains to be constructed only the section 1.6 miles in length between The Oaks and the city of Los Gatos to complete the modernization of the entire route.

"It will be of interest to all present to know that there has been included in the construction budget for the coming biennium beginning July 1, 1939, the following major projects in this immediate vicinity:

Santa Clara County—Between The Oaks and Los Gatos—1.6 Mi.---	\$300,000
Santa Clara and Santa Cruz Counties—Supplemental work from Inspiration Point to The Oaks—	100,000
Santa Clara County—Line change at Austin Corners—1.3 Mi.---	85,000
Santa Cruz County—Between Watsonville and Rob Roy Junction—7.3 Mi.-----	360,000

"In addition to these major construction projects, there is also contemplated for expenditure in this vicinity from funds allocated for minor improvement and betterment projects the sum of approximately \$70,000."

AWARDS TO CONTRACTORS

(Continued from page 18)

be permitted a maximum of three nominations each year. These nominations will be judged by sections for the sectional awards and the winners of these awards will then be eligible for the national award, the recipient of which will be made known at the next annual convention of the American Road Builders' Association.

Salesman—"I would like to see someone with a little authority."

Office Boy—"Well, I have as little as anyone around here."—Winnipeg Tribune.

Russian River Highway Nearing Completion

(Continued from page 30)

round material with upset ends and malleable washers.

TIE RODS PROVE PROBLEM

The placing of the tie rods was the only phase of the work where difficulty was experienced. This was due to the limited space available in which to shift the rods endwise to facilitate placing. It was necessary to bend the rods in order to fit them, then straighten them after they were in place.

The maximum length of pile driven in the bulkheads was 50 feet. The total length of bulkhead amounted to 1230 lineal feet and required approximately 140,000 board feet of treated Douglas fir timber.

Another major item on the contract was the construction of two concrete deck bridges on timber pile bents. The one across Hulbert Creek has a length of 177 feet with 9 bents. The one across Fife Creek is 127 feet long with 6 bents. Hulbert Creek Bridge is built alongside of an existing concrete bridge, the only connection between the two bridges being curb returns at each end.

UNIQUE DECK SUPPORT

By using both bridges a two-way divided structure will be provided at the entrance to Guerneville Park, a very popular recreational spot. This is near the connection between the old and new roads. Seventy to eighty-foot piles were used in this structure. A unique method of deck support was used by the contractor in his form work. He eliminated the use of false bents by supporting the deck falsework from the piles. One and one-half inch "I" bolts were placed over the tops of the piles and extended down through 8-inch by 16-inch cross pieces on each side of the bent. By tightening or loosening the nuts on the bolts, the deck could be readily adjusted to the desired elevation. The cross timbers to which the "I" bolts were fastened in turn supported the stringers which formed the deck support. Fife Creek Bridge is a standard bridge with a 26-foot roadway and two sidewalks.

Grading was done with tractors and earlyalls and has been completed. Several slides developed after the

grading was started, but at the present time they are not moving appreciably.

Northern California motorists who frequent the Russian River resorts are looking forward with pleasurable anticipation to the opening of the new highway, which will greatly facilitate

travel between Northwood Park and Guerneville, popular recreation spots.

The contract was awarded to the Heafey-Moore Co. and Fredrickson & Watson Construction Co., on a bid of \$184,009.10. The time limit was 150 working days; the completion date is August 31, 1939.



This view of construction on the Northwood Park-Guerneville Highway, looking towards Monte Rio, shows steel piles and treated timber bulkheads.

Million-Dollar Highway Opened

(Continued from page 24)

link the completion of which was the occasion for the celebration on July 1. Commissioner L. G. Hitchcock of Santa Rosa and Secretary Byron N. Scott represented the State Highway Commission.

HEAVY TRAFFIC ON ROUTE

Formal opening of the project between Inspiration Point and Oaks Road represents the completion of another link in the construction of the highway between Santa Cruz and Los Gatos.

This particular stretch of highway comprises one of the most heavily traveled recreational highways in California, connecting the densely populated San Francisco and peninsula areas with the scenic attractions and playground facilities of the Santa Cruz and Monterey coast lines.

How increasingly advantageous it will be to the thousands of pleasure seekers who used the existing obsolete highway may be judged from the fact that the traveled distance between Los Gatos and Inspiration Point is reduced nearly two miles.

The number of curves has been decreased from 132 to 20; total curvature will be 1118 degrees instead of 7700 degrees, and the present 75-foot minimum radius of curves is increased to 500 feet. The average surface width of the new highway is 46 feet as compared to the 20-foot existing roadway.

Of the 132 curves on the old road, forty have a radius of one hundred feet or less. The elimination of these traffic hazards alone is believed by the Division of Highways engineers to fully justify the cost of the relocation.

The first contract for the realignment of the Los Gatos-Santa Cruz Highway was let in 1932 and called for a four-lane highway through the heavy mountain sections where curvature is naturally limited, and a three-lane construction through the valleys and flats where easier curvature alignment could be secured. Contracts for additional improvements have been continuously under way since 1932. An important link in the undertaking was completed in 1937 with the opening to traffic of the

Scotts Valley reconstruction at the Santa Cruz end.

FOUR LANES FOR TRAFFIC

The old road, which was graded in 1915 and paved in 1922, is a 15 to 17 foot by 4½ inch, portland cement concrete surface flanked by 1½ foot of 4 inch oil treated shoulders. The shoulder surfacing was added in 1929, 1930, 1931. The new highway provides four lanes for traffic—two

in each direction—with three-foot shoulders. Through one short radius curve of 500 feet at Moody Gulch, a center division strip was provided.

The total cost of the project amounts to \$1,064,000 of which the grading cost for 2,183,000 cubic yards of earth and rock excavation comprises approximately \$524,000.

The Contractors were Heafey-Moore Co. and Fredrickson Watson Construction Co.



This photograph, looking towards Los Gatos, shows new four-lane Los Gatos-Santa Cruz Highway between The Oaks and Inspiration Point, on left, which replaces old highway on right with its dangerous curves and two-lane pavement.

State of California

CULBERT L. OLSON, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

FRANK W. CLARK, Director of Public Works

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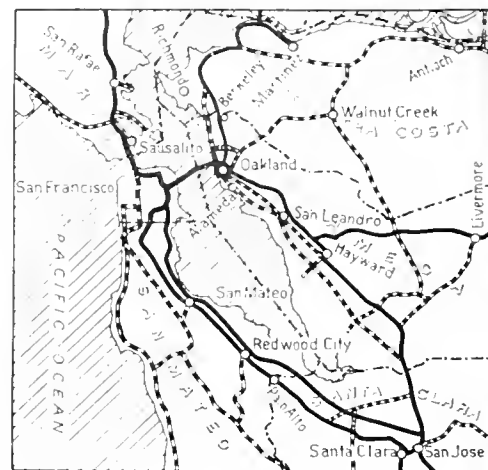
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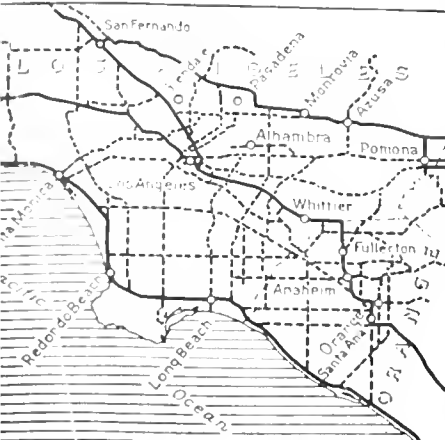
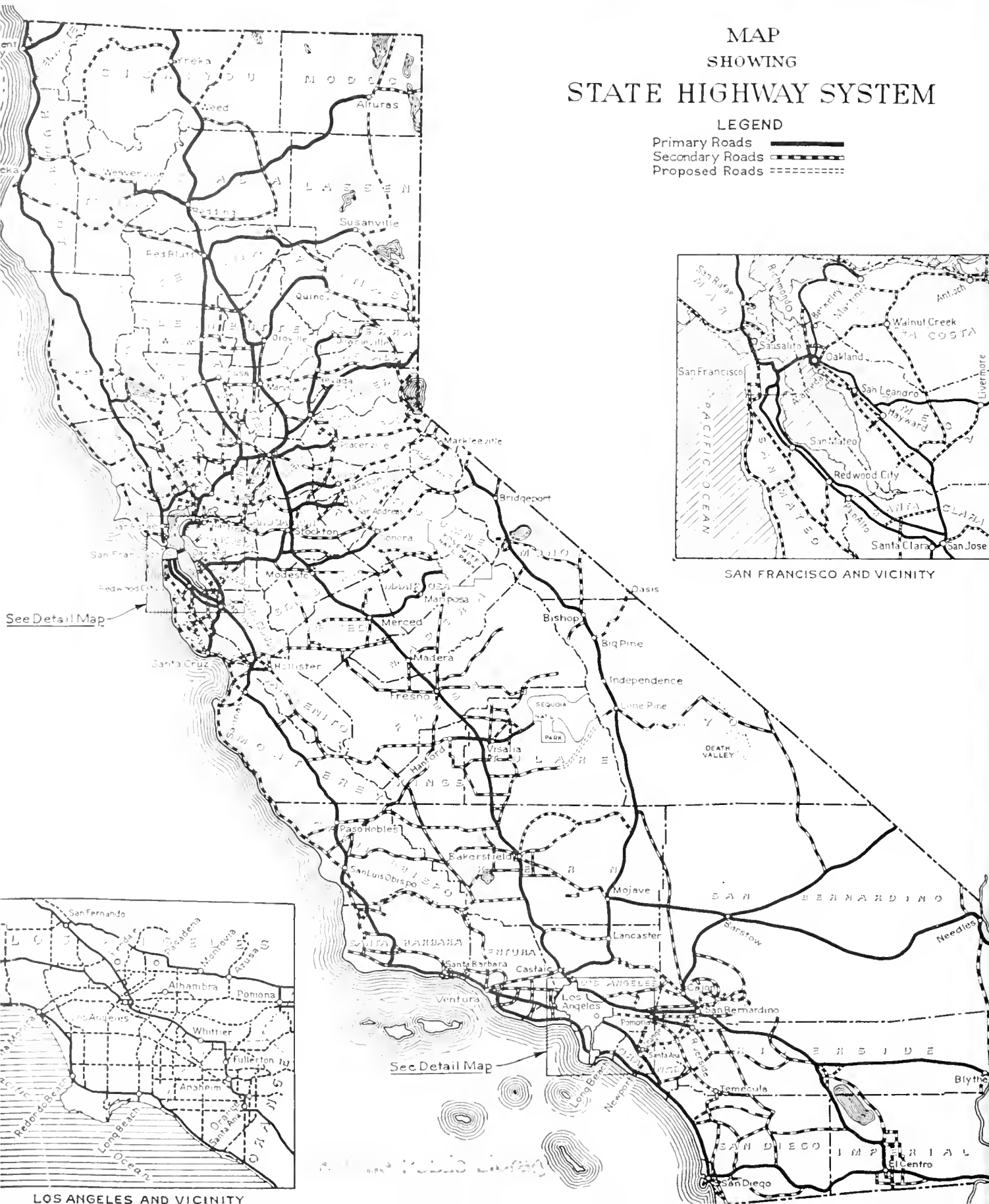
MAP
SHOWING
STATE HIGHWAY SYSTEM

LEGEND

Primary Roads —————
Secondary Roads - - - - -
Proposed Roads
See Detail Map



SAN FRANCISCO AND VICINITY



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HIGHWAYS AND PUBLIC WORKS



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RECENTLY COMPLETED SECTION OF RELOCATED STATE HIGHWAY
NO. 5 BETWEEN LOS GATOS AND SANTA CRUZ

AUGUST
1939

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

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Revised Budget Approved for Construction of Major Highway Projects During This Biennium

DIRECTOR of Public Works Frank W. Clark released on July 3d for publication the revised State highway budget for the current biennium which began July 1, 1939, and comprises the 91st and 92d fiscal years.

This budget, adopted by the California Highway Commission, is a revision of the one prepared by the former Highway Commission which was submitted to Governor Olson on January 7, 1939. While few changes have been made in the totals of funds needed for highway purposes as set up in the former budget, quite a number of changes were made in the list of projects in various counties.

The amount available in the new biennial budget after statutory deductions are made for major highway projects to be constructed throughout the State is approximately \$28,000,000. This sum is allocated to some 200 items or projects of highway improvement as recommended by the Highway Commission after extensive studies and hearings and approved by Governor Culbert L. Olson.

The entire sources of revenue available for the construction, maintenance and operation of State highways to meet the situation set forth above are:

SOURCES OF REVENUE

1—The 3-cent gas tax from which the counties receive 1 cent, incorporated cities, $\frac{1}{2}$ cent, and the State Highway Department $1\frac{1}{2}$ cents.

2—One-half the net revenues of motor vehicle fees after providing for the maintenance of the Motor Vehicle Department and California Highway Patrol.

3—The use fuel tax, or Diesel tax, available only for bridge construction.

4—Regular Federal aid appropriated for the fiscal years 1940 and 1941 by Congress.

Funds Inadequate

In a recent address at the dedication of a realigned section of the Los Gatos-Santa Cruz Highway, Director of Public Works Frank W. Clark said:

"The State of California finds itself today in a somewhat difficult position with respect to its nearly fourteen thousand miles of State highways. This State, having been one of the first to undertake the task of providing its citizens and its thousands of visitors with facilities for motor travel, has created for itself a reputation throughout the nation for the quality and extent of its highway system. The steady improvement of this system which has been effected during the past quarter century has contributed immeasurably to the expansion of motor vehicle use both commercial and private.

"At the present time we are confronted with an ever-increasing volume of highway usage by individuals who demand that these facilities for travel be improved to even higher standards of safety and convenience.

"To meet these demands, however, funds available for the purpose have become increasingly inadequate. This circumstance is illustrated by the fact that for the next two years it is estimated that the total sum available for major construction projects will not exceed \$28,000,000 whereas a conservative estimate of the amounts required at the present time to modernize the existing highway system in accordance with current traffic requirements would total \$511,010,200.

Administration and special study costs for the next biennium are fixed at \$3,600,000. The sum of \$18,200,000 is set aside for highway maintenance, an increase of nearly \$2,000,000 over the past biennium due to increasing maintenance costs resulting from excessive damage to the highways and to the reduction of Federal aid apportionments.

One-half cent gasoline tax allocations to cities is set at \$16,000,000.

Estimated highway revenues from the gas tax, motor vehicle fees, use fuel tax, and Federal aid total \$80,200,000. After deductions for administration and special study costs, the one-half cent allocated to cities and for highway maintenance, there will remain a balance of available funds for other purposes amounting to \$42,400,000.

Distribution of this \$42,400,000 to various purposes provided by statutes to the north and south county groups and to primary and secondary roads, shows the amount that will be available for major construction, not including minor improvements and betterments to be \$28,000,000.

A serious situation confronting the State in the allocation of funds is the bridge problem. Through the addition to the State Highway System of some 6800 miles of county roads, by the Legislature in 1933, the State took over in excess of 1000 bridges, many of which, built in the early days, are of light construction and inadequate for present-day loads.

BRIDGES REQUIRE \$11,000,000

About 400 of these bridges have been posted for limited loads and speeds because they are structurally inadequate to safely support legal loads. Many have reached the stage where reconstruction is imperative to assure a safe operation of vehicles. They are beyond maintenance operations.

(Continued on page 13)

Hydraulicking Highway Cut 210 Feet Deep Through Mountain Completed. 10,748,000 Cubic Yards Moved

By F. W. HASELWOOD, District Engineer

STRICTLY according to a schedule set up in 1933, the hydraulic excavation of 10,748,000 cubic yards for a deep highway cut through the summit of Oregon Mountain in Trinity County was completed on June 30, 1939.

When the cut and the approaches to it from Weaverville and Junction City are completed early in 1940, by the crews of Convict Camp 25, the word "finis" will have been written

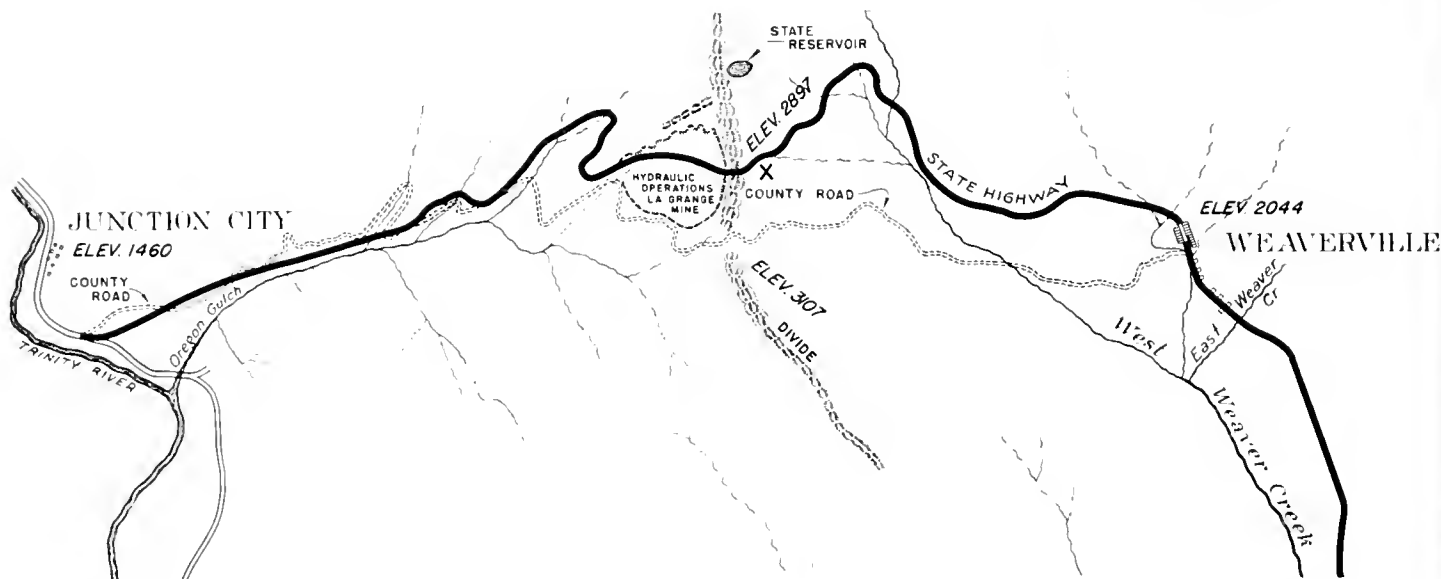
Weaverville, rather than a route from Douglas City, seven miles east of Weaverville, along the Trinity River to Junction City.

Two previous articles in California Highways and Public Works, one in the May issue of 1934 and the other in the May issue of 1935, discussed the problems placed on the highway engineers by this decision and the unique methods employed to solve them.

severe handicaps to construction, to traffic and to maintenance, among which, as recited in engineering reports, were excessive distance, tortuous alignment on long sustained grades with no prospect of future improvement, deep cuts in unstable formations and a road on shady north slopes through a heavy snow area.

THROUGH THE MOUNTAIN

Out of the necessity of providing



Map of State Highway between Weaverville and Junction City. Cut through Oregon Mountain by hydraulicking operations is indicated by X.

to one of the longest stories involving highway routing.

The State Highways Act of 1915 contained this language: "An extension connecting the interior and coast trunk lines in Northern California through Trinity and Humboldt counties, by the most direct and practicable route." It was not until April 29, 1932, that the Highway Commission decided that this language definitely meant an extension of the existing county seat lateral from

This article heralds the completion of a highway construction operation bold in its conception, unique in its execution and wholly effective in its solution of the difficult problem of securing a satisfactory high standard road with low maintenance cost through the barrier presented by Oregon Mountain.

The first survey over the mountain from Weaverville to Junction City was 10.5 miles long. It offered many

"the most direct and practicable route" came the conception of a road through the mountain rather than over it. From 1862 to 1918 the hydraulic mining operations of the LaGrange mine, involving the movement of 100,000,000 cubic yards, had actually removed a large part of Oregon Mountain, although the saddle through which the road would pass to take advantage of the mine excavation was still intact. Likewise, on the north slope of the mine west of the



View of hydraulic giant working on highway excavation in Oregon Gulch. White dash line shows highway grade through cut at summit.

View from summit of Oregon Mountain looking down over proposed highway grade indicated by white line. Hydraulic giant at work in circle.



summit and in motion on the tilted bedrock plane, was a loose mass of several million cubic yards of non-gold-bearing earth and rock. This slide was one of the reasons for the suspension of mining operations in 1918.

If this slide were removed and a deep cut were made through the mountain, the advantages would be a saving in distance, a reduction in the amount of adverse grade and a road on the sunny slope in stable formation throughout.

Quite obviously, no method heretofore employed in highway construction could be used for such a project, since the initial guesses on the quantity to be moved ranged from ten to twenty million cubic yards. A study of hydraulic mining costs revealed that material had been moved for as little as 2 cents per cubic yard and that there were many operations where the cost did not exceed 2.5 cents.

WATER SYSTEM ACQUIRED

The LaGrange Mine had originally been operated by water from Stuarts Fork and Rush Creek, tributaries of the Trinity River, conveyed through 29 miles of flume, ditch, tunnel and siphon. This conduit was then out

of order and would have required an excessive sum for restoration. Fortunately, the LaGrange had acquired an auxiliary system known as the Sweepstakes, which secured water from the drainage areas of East and West Creeks. This system of about 12 miles in length, consisted of six miles of 30-inch riveted steel pipe and six miles of ditch and flume. It could be restored to deliver about 35 second feet for a nominal sum.

The LaGrange equipment available for use consisted of five hydraulic giants from 7- to 9-inch nozzles, much hydraulic pipe ranging from 26 to 15 inches in diameter, and considerable miscellaneous equipment and fittings. On top of this the LaGrange was willing to lease the Sweepstakes system, its water rights and equipment for the period required to complete the excavation for a highway cut. In addition, the LaGrange would provide free use of all of their holdings, including dumping rights in Oregon Gulch and West Weaver Creek.

\$100,000 ALLOCATED FOR ROAD

In the budget for the biennium beginning July 1, 1933, \$100,000 was allocated for the road from Weaver-ville to Junction City. It was not

until late in November, 1933, that final details were worked out with the LaGrange and approval was received to proceed with the work.

Unfortunately, this delayed authorization required construction of a 3,750,000-gallon reservoir in the wettest period of the year, so that actual hydraulic operations were delayed until February 28, 1934, with a loss of half the seasonal runoff.

The first setup of the giant on the tilted bedrock plane on the north side of the mine, with the intention of following this plane as far as possible through the cut. The plane was followed for several hundred feet but was eventually lost under hard, overlying masses that were not in motion, could not be cut with water and therefore did not need to be removed.

When work was started it was the conclusion in the district that from 10,000,000 to 12,500,000 cubic yards would have to be removed. When hard stable masses were found above the bedrock plane, the lower estimate was accepted as more probable.

NEW TECHNIQUE LEARNED

It was necessary for the engineers to learn a new technique in discussing excavation, such as duty, per cent of carry, static and kinetic head and



Partially graded highway approaching hydraulic cut through Oregon Mountain from west. The cut is 2000 feet wide, 2500 feet long, 210 feet deep at top.



Roadway in Oregon Gulch built with hydraulic tailings. Log cribs, fence and brush were used to control deposit of tailings.

other terms common to hydraulic mining. To a miner, the duty of water means the number of cubic yards of material removed per miner's inch in 24 hours. The per cent of carry was better understood by engineers, and references were generally in terms of the ratio of cubic yards of solids removed to the cubic yards of water used.

The regulating reservoir of about 18,500 cubic yards capacity was constructed at elevation 3445. The high point of the road grade in the cut is 2897.

OPERATION OF GIANTS

Water was discharged into the reservoir from the 30-inch steel pipe through a Parshall measuring flume by which a continuous record of the flow was kept. Discharge was through a hand-operated gate through an open ditch leading to the penstock that served the giants. Static heads of from 120 to 263 pounds per square inch were available for the giants, but these heads were frequently reduced by allowing the penstock to be only partly full. Generally, the kinetic or operating head at the giant ranged from 99 to 204 pounds per square inch.

Giants with nozzles from 7 to 9 inches in diameter were used. The operating period with a full reservoir ranged from 1.5 to over 3 hours, depending on the number of giants oper-

ated and the rate of inflow. This rate varied during the operating period from 1 to 36 second feet, the latter being the capacity of the Sweepstakes supply system.

The rate of flow through the giants varied with the head and the size of nozzle. Flows at the rate of 50 to 55 second feet were common. With 55 second feet of water being discharged through a 9-inch nozzle, the velocity is 126 feet per second. With the 7- and 8-inch nozzles, velocities up to 170 feet per second have been recorded.

The hydraulic season at the start of the operation was from October 15 to July 15 and was subsequently reduced by agreement and by statute to from December 1 to July 1. The purpose of this limitation is to prevent pollution of the water in the Trinity River during a specific period. Actually, the lack of water from July to December provides the same limits of the operating season.

Experienced monitor men or pipers, many of whom had worked in the La-Grange, were employed to operate the giants. During most of the operating season, night shifts were employed as no water could be wasted. Electric searchlights provided the illumination. Telephone connection was provided from the giants to the reservoir and to the intake on East Weaver where a caretaker was stationed.

Spoil was discharged west into Ore-

gon Gulch and east into West Weaver. During the work on the east side, it developed that better progress could be made by use of powder in the hard barrier that crossed the line of the cut. Consequently, a powder tunnel some 600 feet long was dug along centerline and grade, and in the tunnel and pockets excavated from it some 40 tons of 5 per cent powder were loaded. The resulting blast loosened great masses of material and, as the work proceeded, the waste channel cut back along the centerline of the tunnel.

One of the major uncertainties was the south side of the cut which was presumed to be all soft material consisting of clay, gravel and boulders in various proportions. It was assumed that this material would stand if sloped back so that the banks did not crumble from their own weight, but there was no certainty as to how it would behave.

Stripping of the south side began in May of this year. It soon developed that several hard formations were encountered, all sloping toward the centerline and being apparently faulted or uplifted portions of a cemented sand or gravel deposit. The existence of these formations limited the amount of stripping to be done and not only assured stability of the south slope but permitted completion of the stripping this season, an accom-

(Continued on page 23)

Santa Monica Grade Separation Project Solves Coast Route Problem

By S. V. CORTELYOU, District Engineer

THE Colorado Avenue grade separation, in the city of Santa Monica, in Los Angeles County has been designed by the State Division of Highways and will be constructed during the next nine months under a cooperative PWA contract by the city for the purpose of relieving one of the most congested and hazardous intersections on the Roosevelt Highway along the coast, which is one of the most heavily traveled highway routes in the State.

The volume of traffic at this intersection will increase very materially with the improvement of sections of the Coast Highway extending south-

easterly from the Colorado Avenue intersection.

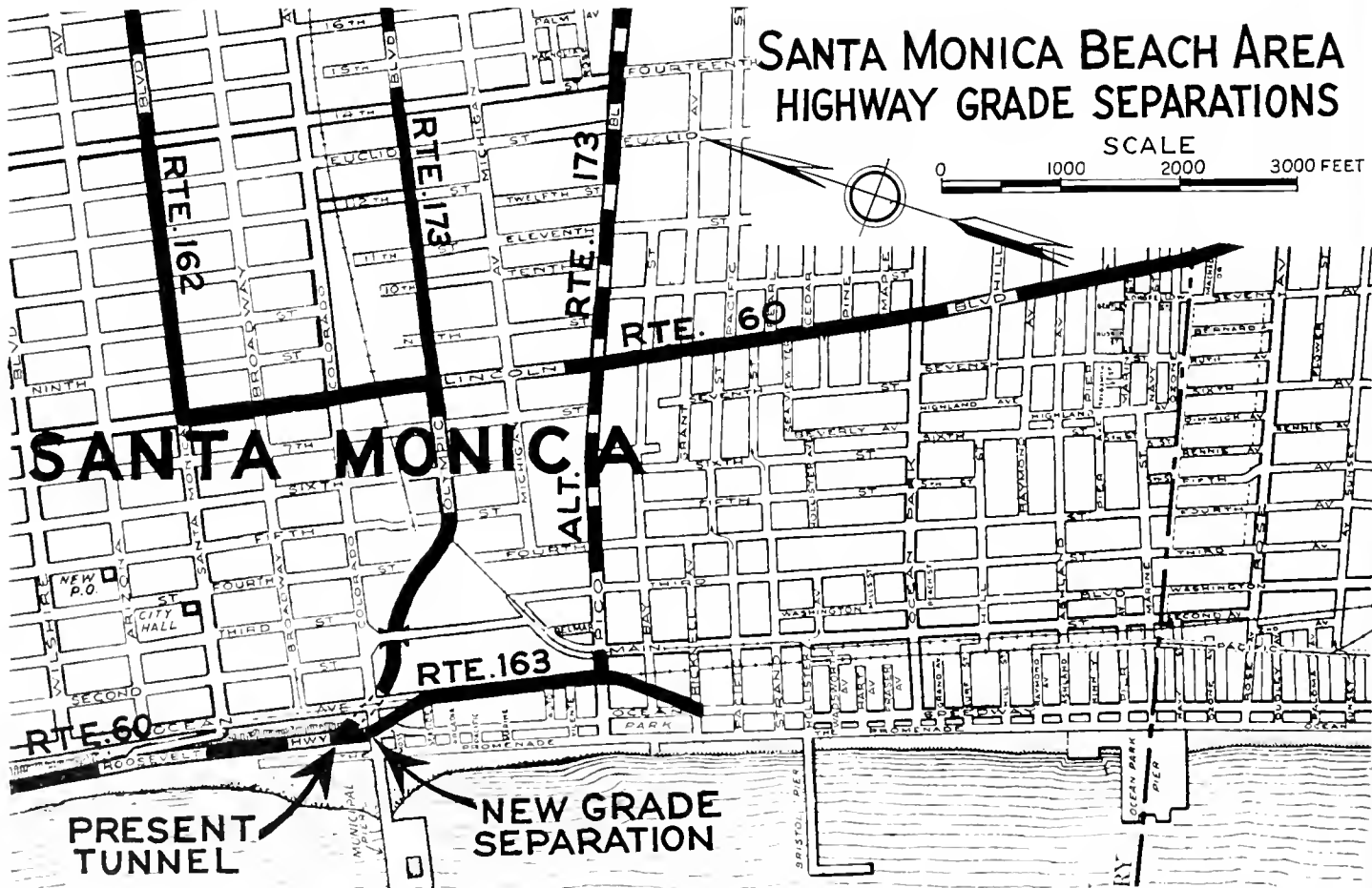
Officially known as State Highway Route 163, the highway closest to the ocean front runs southerly from Colorado Avenue to Venice. It was designated as a State highway route in 1933, and is officially described as extending "from Route 60 (Roosevelt Highway) at a point near Colorado Avenue in Santa Monica to a connection with Windward Avenue in the city of Los Angeles."

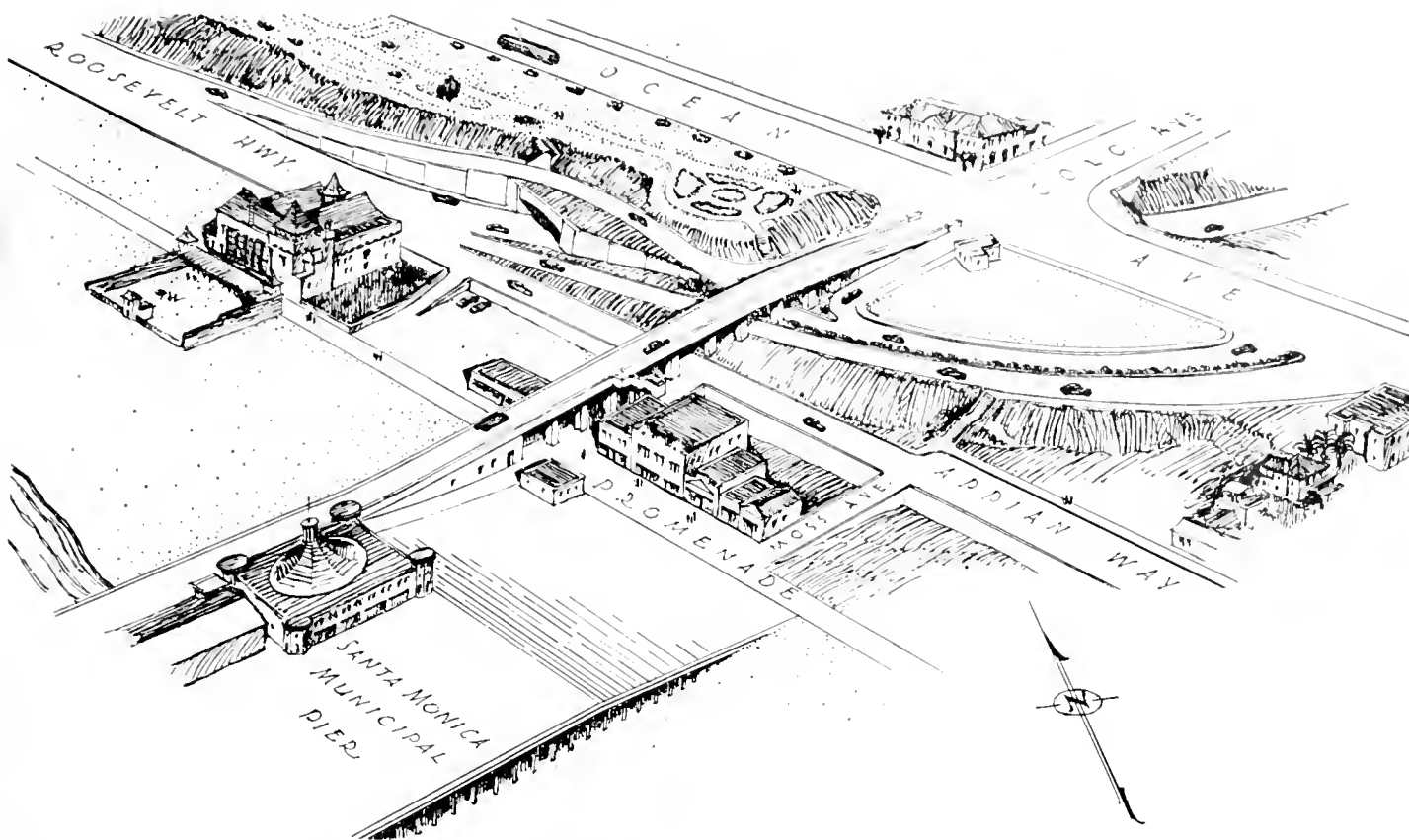
Its general purpose is to provide a highway closely following the ocean front from Santa Monica to the Venice area in the city of Los An-

geles as Route 60 southerly from Colorado Avenue follows Lincoln Boulevard which is some distance inland.

The first State money available for the improvement of Route 163 was \$100,000 set up in the State highway budget for the 1937-39 biennium.

The intersection of Colorado Avenue with State Highway Routes 60 and 163 is located at one of the most highly developed beach areas on the entire coast. Colorado Avenue is an important traffic street extending from the east city limits westerly and crosses Ocean Avenue as well as Routes 60 and 163 to the Santa Mon-





Sketch of Colorado Avenue grade separation project in Santa Monica showing 650-foot bridge structure carrying traffic to the municipal pier over the Coast Highway and several connections permitting free access to congested beach areas.

ia Municipal Pier. This pier affords landing facilities for the Santa Monica Yacht Harbor with its many pleasure boats and fishing barges, and provides an area for numerous amusement concessions.

Sunday crowds using these facilities during the summer months run from 25,000 to 30,000 persons, many of whom drive directly on to the pier with their cars. The fact that a large proportion of these cars must cross the Roosevelt Highway (Route 60) and also Route 163 has brought about a major traffic problem.

Much of the congestion was relieved by construction of a tunnel by the State in 1935 which carries Route 60 traffic under Colorado Avenue and Ocean Avenue to connect with Lincoln Boulevard and points southerly. To complete the solution of this traffic problem, the State in cooperation with the city of Santa Monica, the county of Los Angeles and the U. S. Public Works Administration is proposing to construct the Colorado Avenue grade separation.

The present project including the extension of the existing tunnel and appurtenant ramps and road connections will

1. Provide direct vehicular and pedestrian connection with the Santa Monica Municipal Pier via Colorado Avenue, by which traffic will be carried over Route 163, the Roosevelt Highway and the connection to Appian Way.

2. Permit an uninterrupted flow of traffic on the Roosevelt Highway across Colorado Avenue and Ocean Avenue to its connection with Lincoln Avenue.

3. Give access to the ocean front in the Ocean Park area to southbound traffic on the Roosevelt Highway via Ocean Avenue (Route 163) without crossing Colorado Avenue at grade.

4. Provide access (via Appian Way) from the Roosevelt Highway by connection which will pass under the Colorado Avenue Bridge to the highly developed beach area immediately south of Santa Monica Pier.

5. Permit a free interchange of traffic by means of suitable one way ramps and road connections between the major traffic arteries which converge in this small area.

To accomplish these results a reinforced concrete bridge having an

overall length of 650 feet will be built along Colorado Avenue from Ocean Avenue to the pier. This structure will carry two traffic lanes and two four-foot sidewalks. The grade will be elevated sufficiently at the crossings of Route 163 and the Appian Way connection to permit these two roads to pass underneath.

A one-way two-lane ramp will carry southbound traffic on Roosevelt Highway wishing to continue southerly on Route 163, from a point near the present tunnel entrance, under the Colorado Avenue structure up to a connection with Ocean Avenue, whence it will follow southerly along Ocean Avenue and other connecting streets to the Ocean Park area.

From this same location near the tunnel entrance, a two-lane road will continue southerly along the ocean front, passing under the Colorado Avenue structure and connect with Appian Way and the beach area immediately southerly of the pier.

Northbound traffic on Ocean Avenue (Route 163), wishing to continue northerly along the Roosevelt Highway (Route 60) will use a two-lane ramp passing under the Colorado

(Continued on page 27)



With roadway widened and curves eliminated convenient parking areas are provided on State Route 15 along the north shores of the Blue Lakes.

Lakes Highway Reconstructed

By J. C. BLACK, Associate Highway Engineer

THE Tahoe-Ukiah Highway, State Route 15, is rapidly developing into one of the most important cross laterals in the State Highway System. About fifteen miles east of Ukiah in Lake County this highway follows along the north shores of Laurel Del Lake and Blue Lake, widely known as the "Blue Lakes" for their beauty and recreational features.

Motorists will be pleased to know that the old narrow, winding highway along the lakes has been reconstructed and that the new road eliminates fourteen curves and 590 degrees of angle in a distance of two miles.

In order to secure a modern standard of alignment, it was necessary to construct the new road across several arms of the lakes. Soundings taken during the design period of the project indicated that suitable foundation could be obtained for the embankments across the lake arms if several

feet of very soft mud and peaty matter was displaced. The soundings also showed that the stable foundation material sloped quite steeply downward from the lake shore and then flattened out to an approximately horizontal plane.

To accomplish the displacement of the mud it was proposed to begin the construction of the embankments by end dumping from the shore and, as the embankment built up, to extend the embankment out into the lake. It was believed that the weight of the new material would displace and push the soft material ahead of it and that the bottom of the new embankment would rest on stable material.

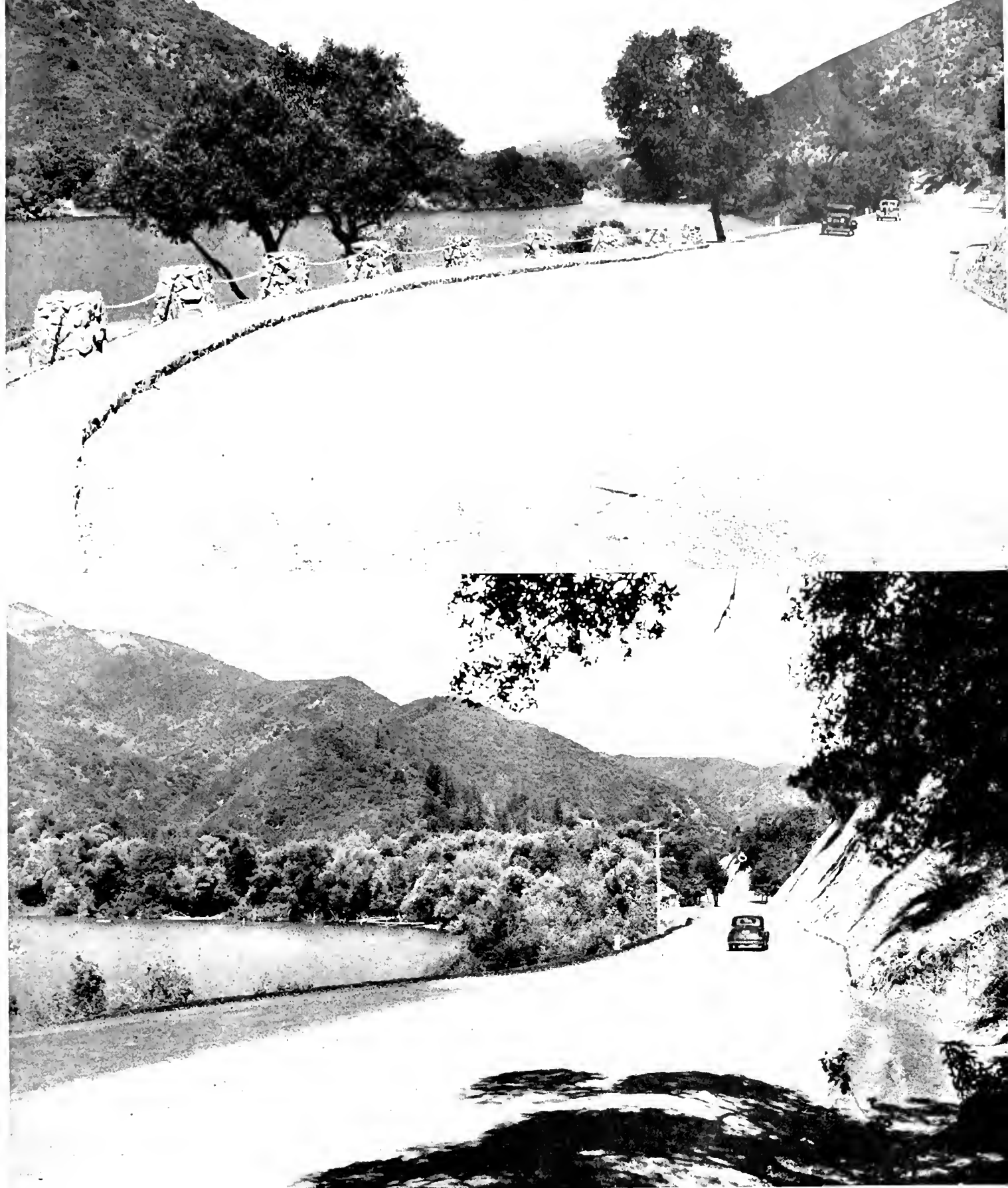
This method was followed during construction. The first embankment across a lake arm was constructed of material consisting of shale and clay. When the top of the fill had reached an elevation of about ten feet above the water line, the entire embankment

slid into the lake.

Soundings taken in the lake showed that the embankment had displaced most of the mud and that a reef had been formed out in the lake. It appeared from these soundings that the reef would act as a support for a new embankment. The embankment was, therefore, reconstructed, using rocky material in the bottom portion. To insure maximum settlement the embankment was surcharged by depositing material above grade. This material was left in place for several days, and no additional settlement occurred.

After the experience obtained from the first fill construction, rocky material was used in the base of all of the other lake embankments except one. No rock was available for the fill between Station 96 and Station 99, and the fill failed the day following its completion. It was necessary to

(Continued on page 27)



Two views of the recently reconstructed section of State Route 15 along the north shores of Laurel Del Lake and Blue Lake generally known as the "blue lakes" in Lake County. Fourteen curves were eliminated in a distance of two miles and parking areas constructed at vista points.

Bank Protection by Fence Types, Tetrahedrons and Jackstraws

By G. A. TILTON, Assistant Construction Engineer

The first installment of an article on bank protection and revetment published in the July issue of this magazine covered general conclusions of a state-wide survey made after the severe storm damage of December, 1937, and February-March, 1938. Class "A" revetment and facing types constructed on prepared bank slopes, were covered in that first installment. This concluding installment describes Class "B" fence types requiring no prepared bank slopes and Class "C" permeable flexible types including tetrahedrons and jackstraws. Newer and untested types developed subsequent to the 1938-9 storms are also described.

FENCE bank protection installations suffered varying degrees of damage along with all other types in the above mentioned storms. On streams with sand-silt beds subject to moderate scour, they were particularly successful where so located as to permit fulfillment of two prime functions.

The first function is that of a training jetty to direct the flow of a meandering stream and concentrate it away from the toe of a bank slope during the rising stage.

Fence types are limited in height and are generally over-topped at flood. It is at this stage that the second and more important function of fence types is performed. At overflow, scour diminishes on the front face of the fence and increases on the bank slope. With the current next to the bank on the outside curve of a stream flowing in a downward and diagonal direction, greatest scour occurs low down at the bottom of the bank. Fence types located at the toe of bank slopes tend to interrupt this downward flow and dissipate it in a horizontal direction over the top of the fence.

Steel Rail and Wire Fence (cable-connected)

This type of installation in double or triple rows consists of 30-foot 60-pound steel rails spaced 12 feet center to center and driven to a penetration of 20 to 24 feet. Rows of rails are spaced 5 feet apart and connected on the face and back with five $\frac{3}{4}$ -inch wire cables and two widths of 58-inch galvanized woven wire. Between the

rows of rails, a filler consisting of alternate layers of brush and rock, or rock only, is placed so that it will settle when scour occurs. Transverse cables tie the top of rails together.

Weakness in steel rail and wire fence was found to lie in its top-heaviness. The downward scouring flow on the bank back of the fence tends to undermine the installation and at the same time lodge debris and sloughing slope material against the back side, causing it to topple over streamward.

To correct this condition, improvements now provide for lateral spurs from the main fence to the bank slope at frequent intervals. For further stability, the top of the rail fence is anchored to the bank slope with $\frac{3}{4}$ -inch cables and concrete blocks on 12-foot centers.

Improvement in the design also provides for a brush and rock fill wire mesh basket between the rows of rail fence that adjusts to scour intact.

Costs of the improved designs of steel rail fence with wire mesh at the time of this writing approximate \$3.40 per lineal foot for a single row, \$6 to \$10 for double fence, and \$13.20 per lineal foot for triple fence.

Iron Pipe and Wire Fence

The light types of pipe fence bank protection consist of 2 rows of pipe and wire mesh. Galvanized pipe 2 inches in diameter 10 feet long are spaced 5 feet center to center and driven to 5 feet penetration. Rows are spaced 5 feet apart, braced longitudinally and transversely with 2-inch pipe and faced with one width

of 58-inch woven-wire mesh. Between the rows of pipe and wire mesh, alternate layers of rock and brush are placed so as to settle into scoured sections.

Improvements in the light-pipe fence design provide for horizontal lateral pipe braces across the top in place of lateral diagonal braces. The diagonal braces have a tendency to hold up the rock and brush backfill and prevent it from settling into scoured section. Fire breaks of rock, only, have also been found to be desirable at frequent intervals.

Timber Fence

Types of fence incorporating untreated timber proved generally unsatisfactory due to rotting at the ground line. For types that incorporate timber or piles, treated material is highly desirable.

PERMEABLE FLEXIBLE TYPES

Steel Tetrahedrons

Cable-connected steel tetrahedrons and steel jackstraws evidenced sufficiently satisfactory service to warrant greater use.

The primary function of the permeable type of bank protection, particularly when used as a jetty, lies in the collection of light drift and retardation of the stream velocity so as to cause deposition of a bar of sand and silt on the downstream side.

The jetties should be of sufficient height to cause formation of a bar deep enough to protect the toe of the bank slope.

Success of this type of bank pro-



Picture No. 1 shows bar formed below steel tetrahedron jetty indicated by X line. 2—Cable connected jackstraws used to stop bank erosion. 3—Steel rail and wire fence backfilled with rock and brush. 4—Wire mesh and rock mattress.



Placing reinforced concrete channel lining on Santa Clara River near Saugus in Los Angeles County.

tection is dependent upon the degree of permeability which in turn is affected by the size and amount of drift carried by the stream. Jetties with too great a solidity, tend to scour under the center and at the outer end.

The cost of 30-foot steel rail tetrahedrons approximates \$120 to \$125 each, or \$4.10 per lineal foot of installation including anchors. The smaller 15-foot steel rail tetrahedrons average around \$50 to \$60 each, or \$3.60 per lineal foot including anchors.

Concrete Tetrahedrons

Reinforced concrete tetrahedrons tend to settle rapidly in a sand-silt streambed and become increasingly ineffective.

Jackstraws

Jackstraws used as permeable jetties gave equally as satisfactory service as the steel tetrahedrons.

The successful use of steel jackstraws as an emergency bank-protection measure was outstanding. To stop or retard caving banks at flood periods, two or more jackstraws cabled together and anchored to safe ground are thrown over the bank into vulnerable spots. The result is a stub jetty pointing downstream that collects drift at toe of the slope; retards the downward flow along the

bank, and retards further undermining of the bank. Use of the steel jackstraws for this purpose has proven so successful on one major stream in California that county authorities have adopted the plan of storing steel jackstraw members ready for quick assembly and placement where needed at flood periods. This plan is favored by the county over that of constructing permanent installations that may or may not be effective the following season where a wandering stream frequently changes its course.

Fifteen-foot jackstraws cost approximately \$20 to \$25 each, or \$1.50 to \$1.80 per lineal foot of installation, including anchors.

IMPROVED DESIGNS

At locations of vital importance where the sandy nature of the streambed is subject to deep scour at flood periods such as to preclude safe use of ordinary revetment types, a type has been developed that consists of a cutoff wall of steel sheet piling 32 feet long backstayed to the bank and supporting reinforced concrete slope paving.

Cost runs from \$40 to \$50 per lineal foot and is warranted only in the most important places.

Wire-Mesh Revetment

Several installations of wire-mesh

revetment have been constructed to protect embankment slopes of bank-run rock. Wire mesh consists of No. 9-gauge galvanized chain-link fencing in 96-inch widths, tied together torevet the slope. The bottom is weighted down with 90-pound steel rails, and the mesh is anchored to the bank with $\frac{3}{4}$ -inch steel bar reinforcement.

The above installations were constructed in 1938-9 and have not as yet had a real test.

Cost runs from 13¢ to 20¢ per square foot.

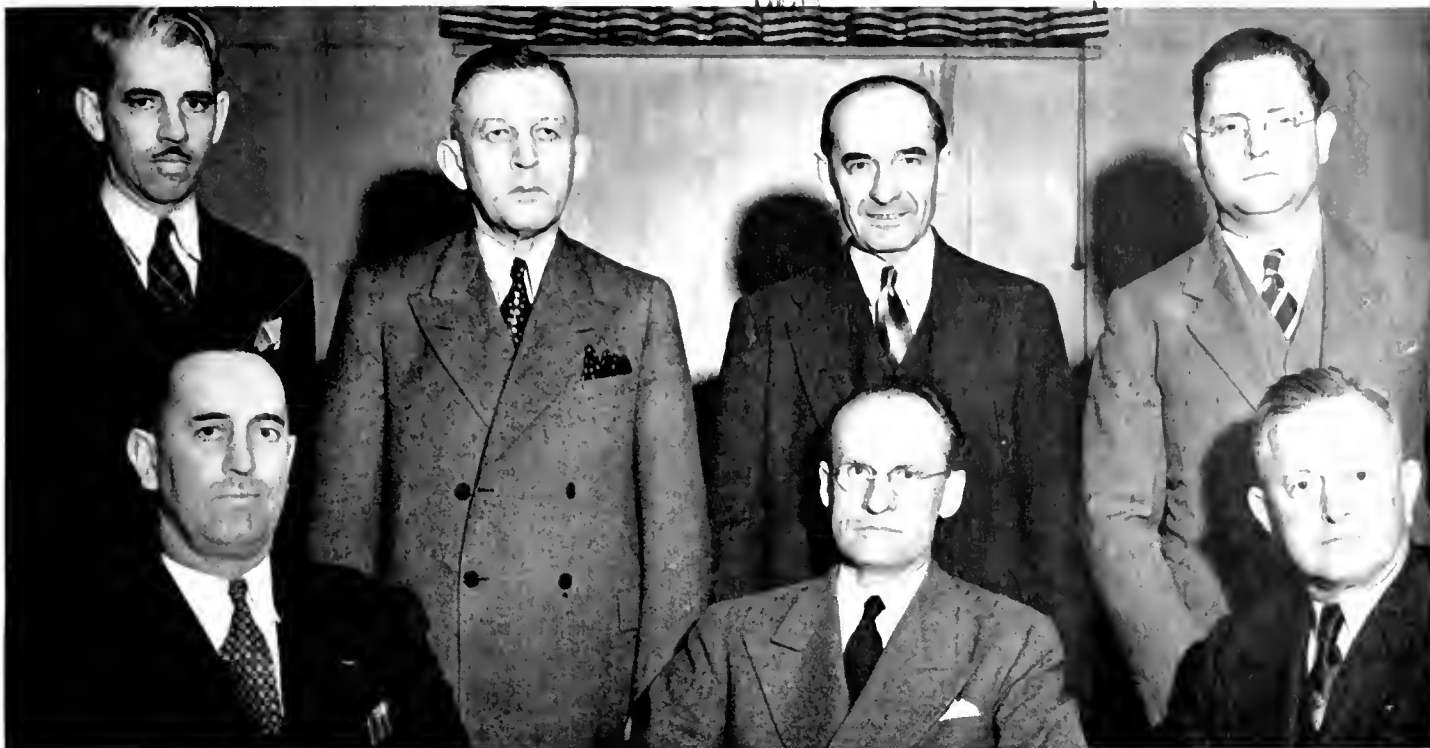
Rock Riprap

At locations where clean graded rock riprap proves to be the economical type and rock of only fair quality is obtainable, grouting of the lower portion of the riprap appears to merit further use.

In the light of the devastating 1937-8 storms in California, and considering the flashy peak flows of most California water courses, bank-protection measures are taking their place as one of the more important highway engineering considerations.

Vicar "I never have christened a child so well behaved as yours."

Mother "Well, you see, sir, for the past week I have been getting him used to it with my flower sprinkler." - *Answers.*



Members of the California Highway Commission, grouped about Director of Public Works Frank W. Clark seated in center are: (left) Lawrence Barrett, chairman; (right) Bert L. Vaughn. Standing, left to right, Secretary Byron N. Scott; Iener W. Nielsen; Amerigo Bozzani; L. G. Hitchcock.

Revised Budget of Major Project Allocation for Biennium Approved

(Continued from page 1)

It is estimated that \$11,000,000 is necessary for reconstructing such unsafe bridges within the next few years, and the State is faced with a total expenditure of more than \$30,000,000 to replace ultimately all of these inadequate structures.

Revenues derived from the use of fuel tax or the Diesel tax assigned by statute to this purpose, are far from sufficient to reconstruct those bridges in immediate need of improvement. It was, therefore, necessary to make a substantial allocation to such bridge projects.

The allocations shown by counties in the tabulations on pages 14-16 totaling \$33,471,172 also include right of way costs and one-quarter cent gasoline tax apportionments to cities where improvement projects within the city limits already are programmed.

A report has also been submitted by Director Clark to Governor Olson covering the work of the Division of Highways during the previous biennium which ended June 30, 1939.

The construction and maintenance work put under way between July 1, 1937, and June 30, 1939, totaled the sum of \$75,621,400.

Construction	
Contracts	\$31,508,700
Miscellaneous day labor	3,200,100
Day labor minor improvements	811,200
Day labor betterments	942,300
Prison labor construction	1,675,400
Engineering	5,440,300
Right of way	4,920,900
Construction subtotal	\$48,498,900
Day Labor	
Maintenance	
General maintenance	\$9,927,400
Replacements	3,758,300
Major slide removal	4,648,700
Buildings and plants	205,000
San Francisco-Oakland Bay Bridge operation and maintenance	780,000
Maintenance subtotal	19,319,400

One-quarter cent apportionments to cities for State highway routes in cities.... \$7,803,100

\$75,621,400

* Note.—An equal amount not included in this report was apportioned to cities for improvement to streets other than State highway routes.

The following tabulation gives the mileage and amounts provided for the various types of highway construction for which contracts were awarded:

Type	Miles	Amount
Grade and pavement....	190.2	\$7,755,800
Grade and plant mixed surface	221.8	4,728,700
Grade and road mixed surface	179.4	4,375,700
Oiled gravel surface....	521.1	1,793,500
Untreated gravel surface	22.5	92,400
Graded roadbed only....	85.0	2,348,800
Dust oiling	84.7	333,100
Shoulder treatment....	84.4	61,900
Bridges and grade separations	(176)	9,515,100
Miscellaneous contracts..		503,700
Total contracts		\$31,508,700

This program was financed by State and Federal funds.

Major Project Allocations in Revised Budget for

Items and amounts in parentheses indicate projects lie in two counties that will share the expenditure allocation.

County	Route	Location	Approximate mileage	Proposed expenditure for construction and right of way
Alameda	69	6th and Fallon to Fruitvale Avenue	2.4	\$860,000
Alameda	107	Near Niles	1.0	111,000
Alameda	108	Sunol to Livermore (portions); Arroyo del Valle Creek		63,000
(Alameda-San Francisco)	5-68	San Francisco-Oakland Bay Bridge (see San Francisco)		(1,000,000)
Alpine	23	Centerville Bridge	0.3	35,000
Amador	97	Jackson Creek Bridge and Approaches	1.5	85,250
Butte	3	South Boundary to Biggs Road	7.4	81,000
Butte	3	Pine Creek to 0.1 mile north of North Boundary	0.5	21,000
Butte	3	17 Bridges between Marysville and Chico		22,500
Butte	87	Campbell Overflow Bridges and Approaches	0.2	18,700
(Butte-Glenn)	45	1 mile east Cherokee Canal to Sacramento River	10.0	75,000
(Butte-Yuba)	87	1/2 mile south to 3/4 mile north Butte County Line (see Yuba County)	1.3	(150,000)
Calaveras	24	At Lime Creek	0.8	33,500
Calaveras	65	San Andreas to Angels Camp (portions)	3.4	171,350
Colusa	15	Long Bridge to Colusa	2.4	90,000
Colusa	15	3.4 miles east Williams to Long Bridge	2.4	25,000
(Colusa-Yolo)	50	Cache Creek Bridge northerly (portions)		75,000
Contra Costa	106	Muir Station to Junction Route 14 (portions)		65,000
Del Norte	71	Smith River Bridge and Approaches		270,000
El Dorado	11	Upper Truckee River Bridge and Approaches	0.3	42,500
El Dorado	11	2 miles east Phillips to 3 miles west Meyers	2.3	18,000
(El Dorado-Sacramento)	11	3 1/2 miles east Folsom to 2 miles east Clarksville (see Sacramento)	5.5	(295,000)
Fresno	4	Fowler to Selma	5.0	204,000
Fresno	41	1 mile north to 1 1/2 miles south Firebaugh; 2 canals (portions)	2.9	61,200
Fresno	41	Squaw Valley to Forest Boundary	3.0	153,000
Fresno	41	Boyden's Cave to Deer Cove	9.0	20,000
(Fresno-Madera)	125	San Joaquin River Bridge and Approaches	2.0	235,000
(Glenn-Butte)	45	1 mile east Cherokee Canal to Sacramento River (see Butte County)	10.0	(75,000)
Humboldt	1	North Scotia Bridge—Eel River	0.7	497,000
Humboldt	1	Robinson Ferry Bridge—Eel River	1.0	671,500
Humboldt	1	At Stegemeyer Bluff	0.4	10,000
Humboldt	1	Elks Creek Bridge near Miranda		51,000
Humboldt	46	Klamath River Bridge at Orleans		159,000
Humboldt	46	Weitchpec to Orleans (portions)		81,000
(Humboldt-Trinity)	20	Willow Creek to White's Bar (portion) (see Trinity County)		(240,000)
Imperial	12	Mountain Springs to Meyer's Creek Bridge	5.3	350,000
Imperial	26	Central Main Canal Bridge		15,000
Imperial	27	East Highline Canal to Gray's Well	24.5	250,000
Imperial	202	3 miles east Calexico to East Highline Canal	8.4	42,000
Inyo	23	Olancho to Cottonwood Creek	9.5	97,000
Inyo	23	3.3 miles north Alabama Gate to Independence	7.0	73,750
Inyo	23	2 miles south of Big Pine to Big Pine	2.0	34,850
Kern	4	Ft. Tejon to foot of Grapevine Grade (portion)		260,000
Kern	23	5 miles north Rosamond to Mojave	7.8	94,190
Kern	23	12 miles north Mojave to Ricardo	13.6	62,630
Kern	58	Keene to Cable (portions)	5.0	366,000
Kern	58	Bear Mountain Ranch easterly	5.0	20,000
Kern	125	Westerly boundary to northerly boundary	5.1	125,000
Kern	142	Beardsley Avenue to Southern Pacific Railroad		145,000
Kern	58	Route 143 to Sivert	7.1	165,000
(Kern-Tulare)	129	Bakersfield to Ducor (portions)		110,000
Lake	49	Putah Creek to Route 15 (portions)		102,000
Lake	15	Clover Creek and Middle Creek Bridges		31,500
Lassen	28	Pit River and Overflow Channels—Bridges		81,000
Lassen	29	Milford to Doyle (portions)	6.0	112,000
Lassen	73	Madeline to North Boundary (portions)	5.3	27,500
(Los Angeles-Ventura)	2	Ventura Boulevard; Calabazas to Conejo Grade (portions)		237,500
Los Angeles	2	Ventura Boulevard, Sepulveda to Topeka		126,500
Los Angeles	4	San Fernando Road, Pacoima Wash Bridge and Approaches		36,500
Los Angeles	2	East Cahuenga Boulevard, Highland to Barham (portions)		150,000
Los Angeles	60	Walnut Canyon to Winter Canyon (portions)	6.0	320,000
Los Angeles	23	Placerita Canyon to Solamint	3.5	350,000
Los Angeles	9	San Gabriel River Bridge Approaches		25,000
Los Angeles	205	Arroyo Seco Parkway (portions)		2,135,000
Los Angeles	26	Ramona Boulevard; Mission Road to West Covina (portions)		760,000
Los Angeles	26	Aliso Street separation at Mission Road		220,000
(Los Angeles-Ventura)	79	Castaic Junction to Santa Paula; Santa Paula and Piru Creek Bridges		300,000

struction of Highways in 91st-92nd Fiscal Years

Items and amounts in parentheses indicate projects lie in two counties that will share the expenditure allocation.

County	Route	Location	Approximate mileage	Proposed expenditure for construction and right of way
Los Angeles	172	3d Street; East city limits to Repetto Avenue	1.7	\$280,000
Los Angeles	175	Strawberry Street; Artesia Avenue; Alameda to Normandie (portions)		220,000
Los Angeles	162	Santa Monica Boulevard; La Brea to Fairfax (cooperative)		40,000
(Los Angeles-Orange)	166-174	Firestone-Manchester Boulevard (portions)		500,000
Los Angeles	61	Angeles Crest Highway; Cloudburst Summit to Mt. Islip		480,000
Los Angeles	161	Colorado Boulevard and El Modena; east city limits west		94,000
Los Angeles	156	Topanga Creek Bridge and Approaches		24,000
Los Angeles	165	Figueroa Street, 135th to 153d Street		32,500
Los Angeles	165	Figueroa Street, Gaffey Street to Wilmington Road		4,500
Los Angeles	165	Figueroa Street, Diamond to Second Street		334,000
Los Angeles	173	Olympic Boulevard (portions)		950,000
Los Angeles	159	Lankershim Boulevard; Bridge across Los Angeles River		220,000
Los Angeles	162	Rowena Avenue; Glendale Boulevard to Hyperion		32,300
Los Angeles	158	Sepulveda Boulevard; Ventura Boulevard to Gamut Street		258,500
Los Angeles	158	Sepulveda Boulevard; Gamut Street to Brand Boulevard		137,000
Los Angeles	159	Lankershim Boulevard; Burbank Boulevard to San Fernando Road		63,000
Los Angeles	157	Foothill Boulevard, at Cobalt		5,400
Madera	4	North Boundary to 2 miles south	2.0	47,000
Madera	4	Madera to 1/2 mile south Cottonwood Creek; Bridge	2.9	200,000
Madera	125	Friant-Madera Road to 1/2 mile north Kelshaw Corners	10.9	60,000
(Madera-Fresno)	125	San Joaquin River Bridge and Approaches (see Fresno County)	2.0	(235,000)
Marin	1	Grand Avenue in San Rafael to San Quentin Wye	1.6	869,000
Mariposa	18	Mariposa to 2.5 miles north	2.5	113,750
Mendocino	1	Outlet Creek to Reeves Creek	4.5	47,000
Mendocino	1	Crawfords Ranch to Ukiah; Robertson Creek	7.0	384,000
Mendocino	1	Haegnys to Bridges Creek Slide	1.1	99,000
Mendocino	16	Russian River Bridge		121,000
Mendocino	48	Flynn Creek to Navarro; Lazy Creek, Yorkville (portions)		101,500
Mendocino	56	Russian Gulch Bridge		172,500
Merced	4	Merced to Black Rascal Creek; Bear and Black Rascal Creek	1.5	254,500
Merced	4	South Boundary to 2.6 miles north	2.6	76,900
Merced	18	Merced to 5 miles east (portions)	5.0	80,000
Merced	32	7 Bridges east of Los Banos		46,000
Modoc	28	4 miles north Rush Creek to Pit River	7.7	280,000
Mono	40	East Boundary Yosemite Park to Gardisky's	2.5	68,000
Mono	96	Route 23 at Bridgeport to Nevada State Line		30,000
Mono	13	West Walker River Crossing to Route 23; 2 Bridges	2.3	75,050
Mono	111	4 miles south of Grant Lake to Grant Lake	4.0	69,850
Mono	13	Leavitt Meadow, Soda, Silver and Wolf Creeks		17,250
Monterey	2	South Boundary to Bradley; Salinas River Bridge	7.3	627,900
Monterey	2	2 miles south Greenfield to Soledad Bridge (portions)	5.0	198,300
Monterey	56	South Boundary to Sur River (portions)		80,000
Monterey	56	Big Sur River Bridge		51,500
Napa	102	Route 6 to Capell Valley	3.2	75,000
Nevada	37	Donner Summit to 1/4 mile west of Donner Lake	1.0	36,000
Nevada	17	1/2 mile south to 1.7 miles north Rattlesnake Creek	2.2	131,000
(Nevada-Placer)	37	Hampshire Rocks to 1/2 mile west Soda Springs (see Placer County)	6.3	(75,000)
(Nevada-Placer)	38	Tahoe City to Truckee Wye (portions) (see Placer County)	14.6	(61,000)
Orange	184	Main Street Extension; Route 60 to Route 43; Newport Bay Bridge	6.4	200,000
Orange	43	Santiago Creek Bridge on Tustin Avenue		55,000
Orange	179	Through Garden Grove; Nutwood Avenue to Ninth Street	0.9	20,000
Orange	64	Route 2 to 1/2 mile easterly	0.5	47,000
(Orange-Los Angeles)	166-174	Firestone-Manchester Boulevard (portions) (see Los Angeles County)		(500,000)
(Placer-Nevada)	37	Hampshire Rocks to 1/2 mile west Soda Springs	6.3	75,000
Placer	37	Colfax Overhead to 0.7 miles north	0.7	55,000
Placer	17	Roseville to 0.6 mile east	0.6	17,500
(Placer-Nevada)	38	Tahoe City to Truckee Wye (portions)		61,000
Placer	39	Tahoe Wye through Tahoe City	1.0	15,000
Riverside	26	Junction Route 19 to 8th Street, Banning	5.8	213,025
Riverside	26	Banning to Junction Route 187	11.6	489,775
Riverside	19	Riverside to 3 miles west	3.0	231,000
Riverside	77	Temescal Canyon and Horse Thief Creek and Approaches	1.0	86,200
Riverside	64	10 miles west of Hemet	3.5	59,500
Riverside	64	1/2 mile east Junction Route 146 to Blythe	2.2	63,000
Sacramento	3	American River to North Sacramento at Underpasses		44,000
(Sacramento-El Dorado)	11	3 1/2 miles east Folsom to 2 miles east Clarksville	5.5	295,000
Sacramento	11	Isleton to Walnut Grove	8.0	87,500
(Sacramento-San Joaquin)	53	Potato Slough to Mokelumne River and Bridge (see San Joaquin County)	5.0	(576,000)
San Benito	22	San Benito River Bridge		12,000
(San Benito-Santa Clara)	2	Sargent Overhead to 0.3 miles south Pajaro River; Pajaro River and S. P. R.R. Separation (see Santa Clara County)	1.9	(314,000)

Major Project Allocations Budgeted for Construction of Highways

(Continued from page 15)

Items and amounts in parentheses indicate projects lie in two counties that will share the expenditure allocation.

County	Route	Location	Approximate mileage	Proposed expenditure for construction and right of way
San Bernardino	26	Redlands easterly (portions)	1.6	\$95,200
San Bernardino	9	Lytle Creek Bridge		25,000
San Bernardino	9	Malaga Grade Separation		15,000
San Bernardino	43	Santa Ana River Bridge		83,500
San Bernardino	190	Power House to Igo	3.0	106,400
San Bernardino	188	Mt. Anderson to Crestline	1.0	78,200
San Diego	12	West of La Mesa Overhead to El Cajon	4.6	284,000
San Diego	2	Las Flores Underpass to San Onofre Overhead	7.2	15,000
San Diego	195-78	Lake Henshaw to Santa Ysabel	7.9	501,500
San Diego	2	International Boundary to 1 mile north San Ysidro	2.9	203,000
San Diego	198	San Diego River Bridge at Lakeside		187,000
San Diego	199	Coronado Heights line change	0.5	32,500
San Francisco	56	Funston Avenue Approach to Golden Gate Bridge	1.5	255,000
(San Francisco-Alameda)	5-68	San Francisco-Oakland Bay Bridge		1,000,000
(San Joaquin-Sacramento)	53	Potato Slough to Mokelumne River and Bridge	5.0	576,000
(San Joaquin-Stanislaus)	110	Vernalis to Gates Road	7.6	140,000
San Joaquin	97	East of Clements to 1.5 miles north; Mokelumne River	1.5	103,300
San Luis Obispo	2	Miles Station Bridge and Approaches	1.5	295,200
San Luis Obispo	56	Santa Maria River Bridge		12,000
San Luis Obispo	56	Old Creek Bridge and Approaches	0.8	53,400
San Luis Obispo	56	Torro Creek Bridge and Approaches	0.5	45,500
San Mateo	68	South San Francisco to Burlingame Structures		40,000
San Mateo	2	Broadway-Redwood City to South Boundary	4.5	511,800
San Mateo	56	Tunitas to Lake Lucerne (portions); San Geronimo, Pompano, Pescadero Creek Bridges	6.0	340,000
Santa Barbara	2	Orella to Taiguas Creek; Refugio Creek	2.6	276,000
Santa Barbara	2	Zaca to 3 miles south; Zaca Creek	3.2	304,900
Santa Barbara	2	Eagle Creek and Dos Pueblos Creek and Approaches	1.2	153,600
Santa Barbara	2	Sheffield Drive to San Ysidro Road	1.2	235,000
Santa Clara	5	Oaks to Los Gatos	1.6	353,500
(Santa Clara-Santa Cruz)	5	Inspiration Point to The Oaks		100,000
(Santa Clara-San Benito)	2	Sargent Overhead to 0.3 miles south Pajaro River	1.9	314,000
Santa Clara	42	Austin Corners line change	1.3	115,000
(Santa Cruz-Santa Clara)	5	Inspiration Point to The Oaks (see Santa Clara County)		(100,000)
Santa Cruz	56	Watsonville to Rob Roy Junction	7.3	485,000
Shasta	3	Pacific Highway relocation at Shasta Dam	11.6	430,000
Shasta	3	Olney Creek Bridge		15,000
Shasta	3	S. P. Subway to Hill Street	2.0	123,000
Siskiyou	3	Bailey Summit to State Line	1.4	150,000
Siskiyou	72	Route 3 at Weed to 1.5 miles north	1.5	71,000
(Solano-Yolo)	6	North of Dixon to 1 mile east Davis; Putah Creek	7.8	385,500
(Solano-Sonoma)	208	Sears Point Toll Road payments		85,602
Sonoma	1	Walls to junction Stony Point Road	3.2	323,000
Sonoma	56	Russian Gulch line change and Bridge	0.8	61,000
Sonoma	56	Timber Cove Creek Bridge and Approaches	0.3	18,000
(Sonoma-Solano)	208	Sears Point Toll Road payments (see Solano County)		(85,602)
Stanislaus	4	South Approach Turlock Overhead	0.3	11,500
Stanislaus	4	Keyes to Hatch Crossing	6.0	321,250
(Stanislaus-San Joaquin)	110	Vernalis to Gates Road (see San Joaquin County)	7.6	(140,000)
Tehama	7	Proberta to Red Bluff Subway; Oat, Coyote and Red Bank Creek	6.2	270,000
Tehama	3	Red Bluff to 5 miles north; Dibble, South Fork Blue Tent Creek	5.0	270,000
(Trinity-Humboldt)	20	Willow Creek to Whites Bar (portions)		240,000
Trinity	20	Oregon Mountain and Helena to Weaverville (portions)	15.0	183,000
Tulare	4	Kings River Bridge to North Boundary	1.3	62,700
Tulare	10	West City Limits Visalia to Route 10	1.3	103,000
Tulare	135	Tule River Bridge and Approaches		22,000
(Tulare-Kern)	129	Bakersfield to Ducor (portions) (see Kern County)		(110,000)
Tuolumne	13	Keystone to Jamestown (portions)	4.0	50,000
Tuolumne	65	Columbia Wye to Sonora; Woods Creek Bridge	2.5	174,000
Ventura	2	Springville to Beeto (portions)	2.0	79,000
Ventura	60	Point Muqu to Little Sycamore Creek (portions)		185,000
(Ventura-Los Angeles)	2	Ventura Boulevard; Calabasas to Conejo Grade (portions) (see Los Angeles County)		(237,500)
(Ventura-Los Angeles)	79	Castaic Junction to Santa Paula; Santa Paula and Piru Creek Bridges (see Los Angeles County)		(300,000)
Ventura	2	Bluffs north of Seaciff		45,000
Yolo	6	West end Causeway Structure		75,000
Yolo	6	1 mile east of Davis to Swingle	3.0	200,000
Yolo	7	Woodland to Cache Creek	3.7	152,000
Yolo	90	Madison to Dunnigan (portions)	4.0	101,500
(Yolo-Solano)	6	North of Dixon to 1 mile east of Davis (see Solano County)	7.8	(385,500)
(Yolo-Colusa)	50	Cache Creek Bridge northerly (portions) (see Colusa County)		(75,000)
Yuba	15	0.3 mile west Bruce's Corners to Dry Creek	1.1	34,500
(Yuba-Butte)	87	1/2 mile south to 3/4 mile north Butte County Line (see Butte County)	1.3	150,000



Planting and cultivating extensive right of way on Coast Route State Highway 56 with ice plant to prevent erosion.

Practical Roadside Development

By H. DANA BOWERS, Landscape Engineer

HIGHWAY landscaping has been the recipient of much criticism of a various and sundry nature, some of which has justification. It is to be noted, however, that the constant demand for improved roadside appearance, together with the apparent economic value of properly applied landscape features, is steadily becoming more noticeable in general highway construction.

Following some ten years of trial, the original conception that roadside development, or "roadside beautification" as it was commonly termed and consisting principally of the planting of trees, shrubs and flowers, is gradually being discarded for the broader, more appropriate and practical concept of roadside development which strives for a more harmonious setting of a necessarily formal roadway into the contours of the landscape.

During the past years we have learned more of the physical and economic limitations of roadside development. We can not compare our State highways with parks or back-

yard gardens. The fact that Mrs. Jones has a most beautiful display of flowering peaches in her yard flourishing "with no care at all," is no criterion for their general use along roadsides. The same applies to wild flowers and many other varieties of plants. Nature designated certain locations and conditions for various types of growth. When deviations are made from these natural laws, unlimited maintenance not possible on the highway must be available, or these plants soon fade away.

The average commercial State highway can not be compared to State or Federal park roads, for strange as it may seem, even though we may deal with much the same class of people that use the park roads, the use of State highways is under entirely different conditions. It is not surprising to see a tourist mother bathe her baby or do the family washing in a State highway drinking fountain. Yet acts of carelessness such as these are a rarity in our Federal and State parks, probably because the majority of the people that visit these parks

are not necessarily of a more appreciative nature and therefore more considerate of the efforts made for their convenience and pleasure, but because they are more impressed and familiar with the more obvious recreational facilities they encounter in a concentrated park development than on a landscaped highway.

The Division of Highways is continually requested both by private and civic bodies to increase activities in all phases of roadside development. Of course the opportunity to provide many types of roadside development is fully recognized. Beautiful picnic spots with sanitary conveniences, and small roadside parks, some with facilities for bathing and boating, could be developed. However, many of those making such requests have but little conception of the magnitude of such an undertaking and are aware of few of the problems and the expense involved.

There is the question, too, whether the State Division of Highways, whose duties are definitely pre-



New cut slopes on the Arroyo Seco Parkway in Los Angeles are grass seeded immediately to get a coverage protection against erosion by early rains. Center—One rain, the first of the season produced this extensive bank erosion. Bottom—Ice plant is protecting this previously badly eroded slope in Solomon canyon.

scribed by law, can properly engage in activities that are primarily a park problem. Mainly, however, the cost of continual cleanup and repair of damage, caused by a careless few, prohibits at the present time any ventures into such a field of roadside improvement.

In general, very little planting is or should be necessary where favorable conditions exist, for there natural coverage usually flourishes. We are often reminded of the fine planting work accomplished by many of the eastern states, but it should be remembered that the ample summer rainfall that prevails in the East makes irrigation seldom needed, whereas in this State plant life develops slowly unless constantly fertilized and watered. Even the use of native vegetation, under the most favorable conditions, is often discouraging and brings criticism because of the years required before any effect is evidenced.

In view of these facts, the Division of Highways has curtailed endeavors along the line of prolific and formal planting and is concentrating on the more basic principles of roadside improvement. It is not always necessary to "gild the lily," for after all we have a naturally beautiful landscape in California, and a road fitted to that landscape needs very little further adornment.

Principally we have one objective in the improvement of highway appearance and that is—harmony. A road blending into the natural contours and covered with endemic vegetation can evoke little criticism from a landscape viewpoint. Harmonious construction, however, is excellent in theory and looks well in the artist's sketch book, but it can easily be carried beyond practical limits. There is much involved in the construction of highways that is of more importance than appearance alone.

To consider that adequate and safe transport lanes can be provided without scarring the landscape is futile. True, there is always a location, if

such is sought, which offers a minimum of scar, but considering the general terrain in this State, plus the demand for higher standards of alignment, grade and road width, some scar is inevitable and even the minimum is apt to be inharmonious.

Since the quest for harmony has an economic limitation, we must be satisfied to strike an agreeable medium and proceed on that basis. It then becomes a matter of sensible roadside landscaping to heal those scars, for if this is not done, any efforts or expense to which we may have gone during construction for the sake of harmony will have been wasted.

The practice of flattening and rounding cut-and-fill slopes which definitely make the road a part of rather than an addition to the landscape has an economic as well as an aesthetic value. An appreciable decrease in maintenance costs in many cases can result from such procedure. However, flattening alone is not sufficient to bring about this saving.

NECESSARY TO PREVENT EROSION

To expose a flat sterile surface to the elements only invites increased erosion. Although it is true that flat surfaces will revegetize more rapidly than steep surfaces, it is essential that some effort be made to aid nature in an early restoration by providing a seed bed of top soil for the protective cover that is so necessary.

In doing this we will have accomplished an important item of work and will have regarded a basic factor in our quest for harmony; namely, the laying of the ground work for the prevention of erosion and for improved appearances.

Often supplementary seeding of low growing grasses is necessary, depending upon the source and condition of the top soil used for the seed bed.

It is most important that the seed be germinated prior to the first rains in order to provide a cover for protection against early storms.

It is not always wise to depend upon the first rains sprouting a protective grass cover since they may be of such magnitude as to completely wash away the entire seed bed. It is apparent that every condition presents its own problem and must be dealt with accordingly.

One of the greatest advantages in the conservation of top soil, aside from the economy of preventing



Blanketing a sandy slope with top soil spread from above with tractor equipment.

erosion, is the amazing rapidity with which it is possible to realize complete revegetation. The top few inches, or "seed coat," nearly always contain large quantities of seeds of endemic plant life. A natural and quick growth can be obtained in this way at small original cost and with no expensive follow-up cost for maintenance.

It may be truly said that more appropriate and practical roadside landscaping can be accomplished with a power shovel and a few trucks for one day than will be produced by planting and maintaining trees and shrubs over the same area for one year. Likewise a few more loads of dirt and a few more hours with grading equipment will do more to camouflage unnatural lines than several years of imported plant growth.

A structure will have a high aesthetic value if it truly represents the purpose for which it is built. This is demonstrated in the flowing and simplified lines of our bridges; beautiful because of their simplicity and

lack of unnecessary adornment. The same line of reasoning, while probably not in so strict a sense, can be applied to roadside development. It is desirable, from an aesthetic standpoint, to accentuate the pleasing, or obscure the objectionable features of the landscape.

TWO PRACTICAL PROCEDURES

This should be accomplished in a simplified and natural manner either by proper road location and consideration of appearances and subsequent maintenance during construction, or by artificial planting, or by both as the conditions require.

The two basic requirements that govern equally an economic and aesthetic plan of highway landscape design may be listed in order of their importance and value as:

1. *Cross Section.* The original roadway cross section design represents the foundation upon which an economic-aesthetic landscape plan may be fabricated. Flat slopes properly treated solve the vegetation



Protective cover produced on sandy slope by seeded thin topsoil blanket.

problem which in turn solves the erosion problem, and the two combine to help solve an important maintenance problem.

In addition to its economic-aesthetic value, the flattened cross section has a definite worth and function as a traffic safety measure. Improved sight distance, shallow and broader drainage channels, elimination of slide debris and greater parking area represent a few of the safety advantages.

The cross section combined with the revegetation of construction scars affords the only method of returning the roadway, which in spite of its necessity violates the normal contours of the landscape to a more acceptable appearance in the natural setting and thus makes it the focus of a design for enhancing the charm of nature, instead of diminishing it.

TOP SOIL BLANKETS

2. *Protective Cover.* Newly exposed slope surfaces are sterile and slow to revegetize. *Constant erosion prohibits the establishment of protective cover by natural means.*

A fertile top soil blanket provides a natural growing condition, and vegetation whether imported or native is given a better chance for survival against the elements.

Whenever natural growth is removed, nature at once assumes the task of restoration, in harmony with the climate and species of the particular region. The operation is slow and more often without success where natural seed dissemination must reclaim a sterile or constantly disturbed surface, but it is comparatively rapid where the soil is not destroyed.

Even under the most favorable conditions natural revegetation is too slow to afford protection against excessive runoff or erosion. Obviously, then it becomes highly practical to supply the much needed protection by artificial means accomplished in a natural manner. By so doing results that would normally take several years may often be secured in one.

It is singular that these seemingly common sense principles of construction are being brought to the fore of late, not so much from an economic standpoint, as one might expect, but from the standpoint of roadside appearance. It would naturally appear that the reverse of this fact should be true.

Highway landscaping is often looked upon and tolerated as a necessary evil rather than a functional

Fine Roads Await Motor Visitors to 1939 State Fair

WHEN Governor Culbert L. Olson greets the crowds at the State Fair in Sacramento this year, September 1 to 10, inclusive, they will find smooth, dustless roads and walks that have been practically repaved by the State Division of Highways.

Working with funds provided under an arrangement with the Department of Finance and the State Agricultural Society, the highway division added \$15,575 in improvements to the roads and pathways of the fair.

The principal improvement consists of the reinforcement of all areas by the use of SC4 plant-mixed surfacing material, in most instances one inch compacted.

In weak areas two inches of the material was used in bringing to grade trenches which had settled and in patching potholes throughout the grounds preparatory to sealing.

In spots previously unsurfaced 3½ inches of road rock was added to native soil, thoroughly prepared, rolled and a prime coat of SC2 liquid asphalt added.

Patching of broken areas near the stables was another important improvement which the highway division took care of.

Following the patching and building a seal coat of emulsion was spread over the entire area at the rate of one-sixth of a gallon per square yard and sand applied.

C. W. Rust, Sacramento, who supervised the work, said that this surfacing provides pathways not injurious to footwear, gives a uniform

constituent of highway development. There is much of value aside from the aesthetic to be derived from highway landscaping. Unfortunately, inexperience in past procedure has tended to create a wrong interpretation of the work involved; however, we are now endeavoring to illustrate the practicability of properly applied economic-aesthetic roadside improvement in our landscaping projects.

A second installment of this article by H. Dana Bowers, landscape engineer of the Division of Highways will appear in a following issue of this magazine.

appearance to the roadways and guards against the absorption of moisture during the winter months.

FINE HIGHWAYS TO FAIR

Millions of road miles will be covered by the hundreds of thousands of visitors who will wend their way to the eighty-fifth California State Fair.

Fair time gives the people of the State an opportunity to observe the great highway system which permits easy travel from every point in California to the Sacramento grounds.

Highways lead in from all directions and in every instance they are well paved, properly marked and safely patrolled.

In the last few years the improved highways have made possible transportation of stock and other exhibits from the most outlying sections and have been highly instrumental in building up the fair's huge list of displays.

Sacramento is ideally situated as a fair center. There are direct arterials from the north, south, east and west, all in excellent condition.

The fair last year, under the direction of Secretary-Manager Robert Muckler, became first in the nation when nearly 640,000 persons passed through the gates. This year fair directors anticipated a crowd of 700,000 with an increasing use of the State's highways.

Stafford Goes to New Mexico

Harlowe M. Stafford, Supervising Hydraulic Engineer of the State Division of Water Resources, has accepted a position with the National Resources Committee as engineer in charge of the Pecos River Joint Investigation in New Mexico and Texas with headquarters at Roswell.

A complete study and report is to be made of the water resources, uses and requirements, flood problems, etc., as basis for a settlement by compact between the States of New Mexico and Texas. The job is expected to require two years of work and result in plans to effect maximum conservation and utilization of available Pecos River water resources.

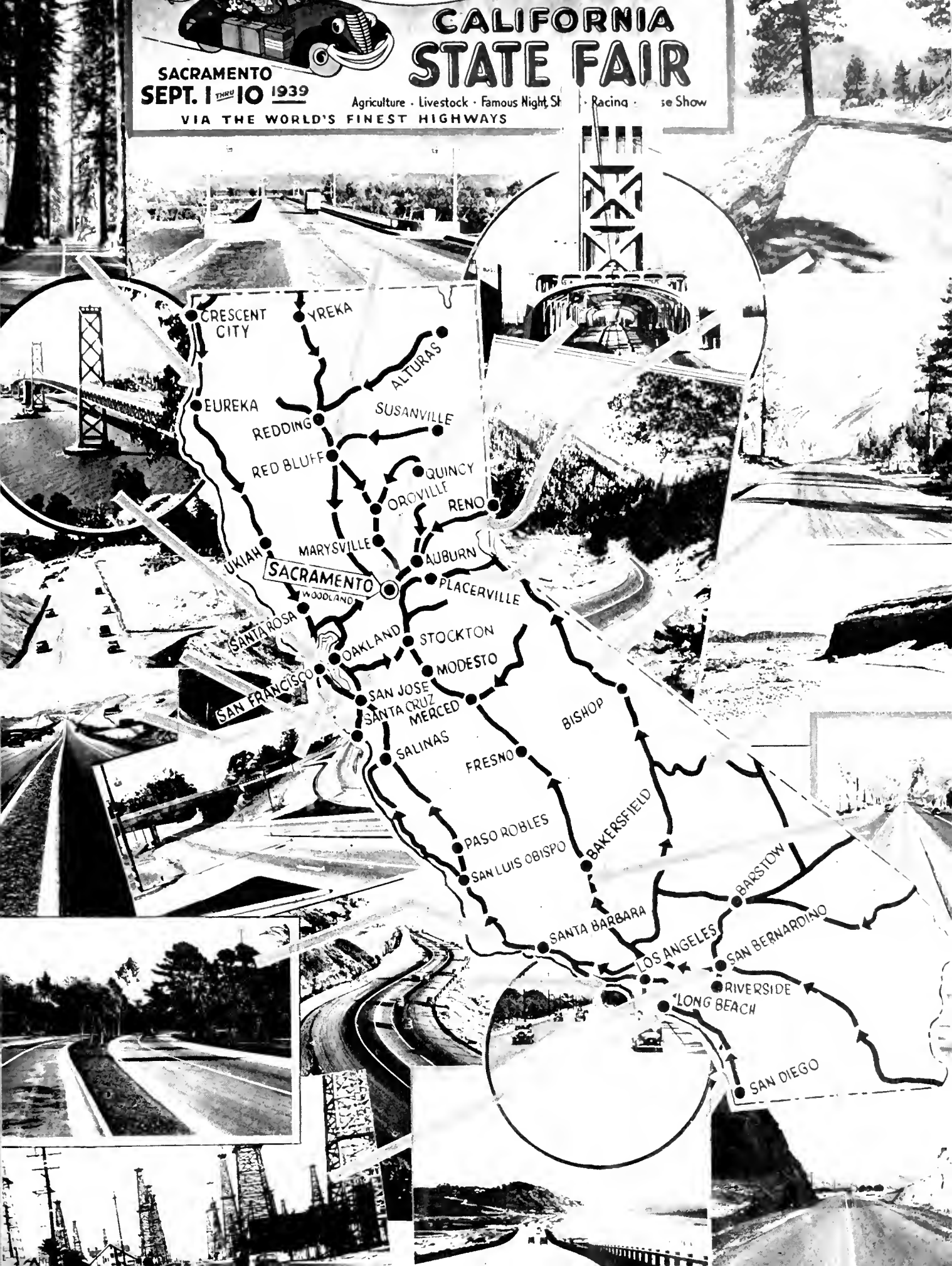
SACRAMENTO
SEPT. 1 ^{THRU} 10 1939

VIA THE WORLD'S FINEST HIGHWAYS

CALIFORNIA STATE FAIR

Agriculture · Livestock · Famous Night Shows

· Racing · Ice Show



Link of Sierra-to-the-Sea Highway Improved Through Kings County

By C. F. OLIPHANT, Associate Highway Engineer

AN IMPORTANT link in the Sierra-to-the-Sea Highway, located in Kings County between 0.6 miles north of Armona and Hanford, was recently completed by the Union Paving Company of San Francisco at a cost of \$102,176. The construction followed the old alignment with changes at each end of the project.

A right-angle turn near the westerly end of the project on the old road at the intersection of two county roads was eliminated by constructing a 1000-foot radius curve.

A new approach was made at the easterly end of the project to Seventh Street at the west city limits of Hanford, which street traverses the city to the east city limits.

This change allows traffic to pass through Hanford on a tangent without interference of the business section congestion or making sharp turns

at city street intersections, as was the case on the old route.

The grades were raised through certain portions of the project to provide better sight distances at bridge crossings and to provide sufficient clearance for drainage purposes between the subgrade and the surrounding terrain.

The existing pavement was resurfaced with a minimum of two inches of asphalt concrete.

On portions where the grades were raised the new pavement is 7 inches thick with edges thickened to nine inches. It is 22 feet wide and bordered on each side with seven-foot oiled shoulders.

The asphalt concrete was mixed in a standard asphalt paving plant with a 3000-pound capacity pugmill.

An automatic batcher was successfully used on this project. This batcher had on previous jobs given

inaccurate results, but by mounting the weigh box and automatic scales on a steel framework, which was not attached to the plant proper, nearly all the vibration from the plant to the scales was eliminated, thus remedying the trouble formerly experienced.

An important feature of the project was the construction of the P. C. C. recessed curbs for the islands which provided the channelization of the intersection at Lacey Boulevard.

This intersection is provided with sodium vapor lamp amber flashers and red reflectors which amply illuminate and indicate the curbs and channels.

Judge—"What is the defendant's reputation for truthfulness?"

Witness—"Excellent, your honor. I've known him to admit he had fished all day without getting a single bite."—*Annapolis Log.*



Improved section of highway near Hanford showing channelization of intersection at Lacey Boulevard which is provided with sodium vapor lamp amber flashers and red reflectors.



Portion of recently completed link of Sierra-to-Sea highway through Hanford which avoids business section congestion in city.

Hydraulicking Highway Cut 210 Feet Deep in Mountain Top Completed

(Continued from page 5)

ishment that appeared doubtful for a while.

There remain in the main summit cut to be removed by equipment about 92,000 cubic yards. The maximum depth of the equipment cut will be 60 feet. Some of the remaining material could be removed hydraulically, if it were blasted, but, since it is needed for fills at either end of the cut, such removal would not be economical.

The hydraulic cut is 2,500 feet long, 2,000 feet wide at the top and 210 feet deep. The bottom of the cut ranges from 50 to 250 feet wide. This extra width will eventually be reduced by weathering of the soft material in the high bank on the south side of the cut.

Little attempt was made to utilize the tailings for construction of embankments. However, by means of log cribs, brush and fence barriers, some 62,000 cubic yards of the tailings were utilized to build up the grade in Oregon Gulch down which the bulk of the tailings were washed. The actual area built up by control of the tailings was about 200 feet wide, 8 feet deep and 4000 feet long.

The 62,000 cubic yards is the quan-

tity required for neat roadbed construction only, and, based on this quantity, the unit cost was 30 cents. On the built-up area adjacent to the road in Oregon Gulch, a growth of vegetation and trees is being promoted to provide resistance to erosion and to improve the roadside appearance.

Throughout the entire project there was a close coordination with the work of Convict Camp 25, from which 26 miles of road will have been completed early in 1940 when this project is finished. Equipment from this camp was working up to each end of the cut when the hydraulic work ceased.

The accompanying tabulation is a concise record of the rate of progress and of the results secured.

A total of 10,748,000 cubic yards of material was removed by the hydraulic operations in 5.5 years. The first giant was operated on February 28, 1933, and the last on June 30, 1939. During this period the total operating time, that is, the total time that water was flowing from the reservoir to operate one or more giants, was 8,196 hours.

During this time, 55,524,400 cubic

yards of water passed through the giants. It will be noted that the average rate of excavation was 8,060 cubic yards per day or 1,310 cubic yards per hour operated. The average per cent of solids, or ratio of material moved was 19.3, and the unit cost of excavation was 2.47 cents per cubic yard.

Several benefits result from the deep cut through Oregon Mountain which could only have been accomplished by hydraulic methods.

The summit is 210 feet lower than could otherwise have been attained.

The distance between Weaverville and Junction City has been reduced 2.5 miles.

The road is on the sunny slope and in stable formation.

The character of the material encountered in the excavation is such that but two miles will require any base course of surfacing.

Although six years have been required for construction since the conception of the project, a similar length of time would have been required by any other method or any other route, since the hydraulic cut was actually finished before the roadway on either side, under construe-

Summary of Hydraulic Grading Operations on State Highway No. 20 Over Oregon Mountain

Year, Month	Days	Excavation, Cu. Yds.	C. Y. day	Unit cost, cents	Water C. F. S.	Water Cu. Yds.	Per cent solids	Hours operated	Cubic yards hour
1934 -- March	32	178,000	5,560	4 20	16 6	1,695,850	10 6	202.5	880
April	30	254,000	8,500	3 02	16 7	1,602,450	15 8	264.5	960
May	31	235,000	7,580	2 43	9 3	920,850	25 3	164.2	1,430
June	30	155,000	5,150	2 07	4 7	450,700	34.3	82.2	1,880
July	12 ¹ / ₂	18,000	1,440	2 54	1 5	60,590	29.7	11.7	1,640
Season	135 ¹ / ₂	840,000	6,200	2 92	10 9	4,730,440	17.8	725.1	1,160
October	1	2,000	2,000	3 27	2 9	9,400	21.3	1 8	1,110
November	30	256,000	8,530	1 97	5 4	519,040	49.2	88.6	2,880
December	31	200,000	6,450	2 41	7 3	714,150	28.1	103.4	1,940
1935 -- January	31	63,000	2,030	6 85	4 4	434,260	14.5	51.2	1,230
February	28	350,000	12,500	1 68	12 2	1,102,670	31.7	207.9	1,690
March	31	317,000	10,200	1 79	10 5	1,045,150	30 3	161.7	1,960
April	22 ¹ / ₂	700,000	31,100	1 04	25 3	1,822,150	38.4	322.9	2,160
May	31	933,000	30,100	0 96	32 5	3,225,670	28.9	542.3	1,720
June	30	224,000	7,460	2 15	16 7	1,606,520	13 9	278.8	800
July	14	23,000	1,660	6 67	5 8	260,520	8.8	47.1	490
Season	249 ¹ / ₂	3,068,000	12,300	1 55	13 5	10,739,530	28.6	1,805.7	1,700
October	15	11,000	60	3 97	0 5	25,600	3 9	0.8	1,250
November	30	10,000	330	3 00	0 5	50,300	19 9	11.4	880
December	31	27,000	870	8 67	1 3	131,370	20 5	34.9	770
1936 -- January	31	125,000	4,020	3 61	7 7	769,930	16 3	140.8	890
February	29	394,000	13,600	2 40	12 9	1,185,500	33 2	214.8	1,830
March	31	494,000	15,900	2 07	23 6	2,319,400	21.3	412.5	1,200
April	30	472,000	15,750	1 65	27 9	2,670,000	17.7	306.8	1,540
May	31	598,000	19,300	0 79	29 9	2,972,000	20 1	359.8	1,660
June	30	200,000	6,670	2 39	15 0	1,445,700	13 8	194.8	1,030
July	10	47,000	4,700	6 38	6 4	198,400	23.7	27.4	1,720
Season	268	2,368,000	8,840	1 99	13.7	11,767,730	20.1	1,704.0	1,390
October	15	2,000	130	2.62	0.3	12,100	16.5	2.0	1,000
November	30				0.1				
December	31	4,000	130	30.51	0.4	43,850	9.1	8.2	490
1937 -- January	31	2,500	85	7.50	0.3	25,410	10.2	4.5	580
February	28	3,400	120	12.05	0.3	27,220	12.5	4.8	710
March	31	188,000	6,060	4.57	3.8	381,070	49.4	72.5	2,890
April	30	165,000	5,500	4.60	16.5	1,586,070	10.4	301.6	550
May	31	538,000	17,400	2.10	32.6	3,232,370	16.7	404.6	1,330
June	26	277,000	10,700	2.68	23.7	1,971,370	14.0	298.3	930
Season	253	1,180,000	4,660	3.11	12.4	7,288,700	16.2	1,096.1	1,080
December	32	102,000	3,200	7.66	13.9	1,394,400	7.3	235.0	430
1938 -- January	31	187,000	6,020	5.20	12.7	1,260,500	14.8	157.4	1,190
February	28	80,000	2,860	10.11	8.3	741,300	10.8	102.3	780
March	31	255,000	8,230	3.49	15.6	1,551,800	16.4	233.1	1,090
April	30	522,000	17,400	1.69	26.3	2,518,500	20.8	386.7	1,360
May	31	432,000	14,000	2.20	33.1	3,286,630	13.2	497.1	870
June	30	284,000	9,460	3.84	30.2	2,860,220	9.9	421.4	670
Season	213	1,862,000	8,740	3.43	20.0	13,613,800	13.7	2,033.0	920
December	31	99,000	3,190	6.41	6.2	618,000	16.0	91.1	1,080
1939 -- January	31	88,000	2,840	7.30	4.3	430,500	20.4	62.4	1,680
February	28	77,000	2,750	7.12	4.3	386,500	19.9	47.2	1,630
March	31	230,000	7,420	3.04	18.0	1,779,500	13.0	225.3	1,020
April	30	496,000	16,500	1.86	25.7	2,468,700	20.1	267.3	1,860
May	31	292,000	9,400	2.19	12.5	1,244,530	23.4	136.0	2,140
June	30	148,000	4,930	3.33	4.8	455,370	32.4	65.1	2,270
Season	212	1,430,000	6,740	3.20	11.0	7,384,200	19.4	884.4	1,620
Grand totals	1,331	10,748,000	8,060	2.47	13.0	55,524,400	19.3	8,196.1	1,310

tion by prison labor, was completed. The hydraulic operations were under the direction of Milan A. Senger until July, 1937, and since then under the direction of Harry L. Waste,

Superintendent of Convict Camp 25. As referred to in a previous paragraph the only remaining excavation work to be done at the summit is deepening of the cut an additional 60

feet. Crews from the convict camp are now doing that work. W. B. Little was resident engineer until July, 1935. R. L. Gerry succeeded him.



Newly paved portion of Orange Belt highway in Tulare County has 22-foot roadway with 17-foot shoulders on each side.

Improved Highway Through Exeter City

GRADING and paving with plant mix surfacing was completed on June 10, 1939, by Piazza and Huntley, Contractors, on an important link in the Orange Belt Highway, between the south city limits of Exeter and Venida Substation at the intersection of the Bakersfield-Gen. Grant Park road and the Visalia-Sequoia Park Highway.

The cost of this construction was approximately \$59,800, financed jointly by the State and PWA Federal funds.

The new pavement is five-inch crusher run base with 2½-inch plant mix surfacing 22 feet wide. Seven-foot oiled shoulders border each edge of the pavement.

Through the city of Exeter the old grade was raised just enough to permit the placing of the pavement, while from the north city limits to the northerly end of the project the grade was raised enough to permit placing of needed drainage structures, in some instances from two to three feet.

In many places during storms the old road had been flooded, causing hazardous traffic conditions. The new grade prevents this possible flooding.

Approximately 45,300 cubic yard of imported borrow was used in raising this grade.

Bay Bridge Traffic Breaks Record; 1,093,502 Vehicles Cross in July

MORE than a million vehicles crossed the San Francisco-Oakland Bay Bridge in July. With a daily average of 35,274 vehicles, the total piled up last month by the Bay Bridge was 1,093,502, an all time high. This record shattering total was revealed yesterday in a report filed by Director of Public Works Frank W. Clark with Governor Olson, Chairman of the California Toll Bridge Authority.

The July figure showed a 48 per cent increase over the corresponding period of last year and a 22 per cent increase over June.

Revenues last month amounted to \$466,771.30, 6 per cent increase over the preceding month, and a 21 per cent increase over July's totals of last year.

Number of vehicles to cross the bridge since it opened November 12, 1936, to August 1, 1939, is 25,063,024.

July's traffic was swelled by exposition-bound motorists, with 242,871 vehicles going to Treasure Island. Exclusive of these motorists, bridge traffic for July was 850,631, or an increase of 15 per cent over July, 1938. It was a drop from July, 1937, before the ferries cut their tolls, when 886,054 vehicles crossed the span.

Highest day of July was the fourth, with vehicles totaling 43,508. Lowest day was July 31, which had a total of 30,761 vehicles.

Last month's record traffic was attributed by Director Clark to a combination of factors, which included a highly stimulated travel season, due largely to the exposition, and to the recently reduced toll to 40 cents.

"It is still too early, however, to determine the exact effect of the reduced toll in its relation to increased traffic," Mr. Clark said.

July totals and comparative figures follow:

	July 1939	July 1938	June 1939	Total 1939	Total since opening
Passenger autos and auto trailers.....	1,011,424	669,438	803,846	5,423,842	23,131,514
Motorcycles and tricar.....	4,376	4,035	3,995	24,277	111,176
Buses	9,221	13,467	7,998	58,091	305,725
Trucks and truck trailers.....	44,850	35,952	47,735	322,348	1,082,247
Total vehicles	1,093,502	737,378	888,395	6,001,835	25,063,024
Extra passengers	346,905	241,163	302,140	1,961,716	6,710,351
Freight tons	56,016	43,750	61,999	421,883	1,333,013



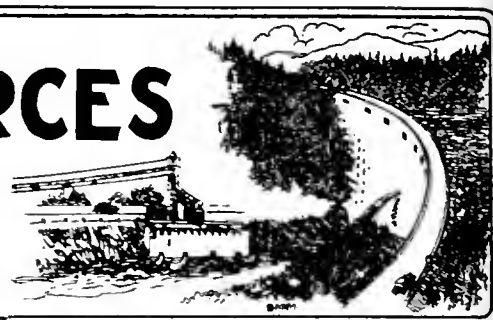
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

JULY, 1939

EDWARD HYATT, State Engineer



The Division of Water Resources, representing the Water Project Authority of the State of California has continued the compilation and analysis of data collected on lands in the San Joaquin Valley as provided for in an agreement between the Authority and the United States of America in connection with the Central Valley Project.

Work was continued on the preparation of folios of maps showing the topography, soil survey data and land ratings of lands adjacent to the San Joaquin River, and reports covering underground water conditions and supplies of lands adjacent to the river.

Also, as provided for in the agreement between the Water Project Authority and the United States negotiations were continued with public utility companies in connection with relocations of power and communication facilities for the completed Central Valley Project and the temporary relocations necessitated by construction activities. Studies were continued with regard to the disposal and distribution of power which will be available from the Shasta power plant, including the programming of additional facilities to provide for the absorption thereof in the market of northern and central California.

SPECIAL INVESTIGATIONS

Investigations and the preparation of reports on work for which applications have been made for allotments from the State Emergency Fund for the restoration of property, levees, flood control works, county roads and bridges damaged by the floods of the 1937-1938 winter season, were continued and 18 reports and recommendations were submitted to the Director of Finance pursuant to his instructions. No allocations of additional money were made by the Director of Finance for flood damage repair work and the total amount of outstanding allocations at the end of the month was \$4,497,900.

The Division has performed, or is performing considerable of the work for which these allocations were made and the remainder is being done by the applicants under 160 contracts with the Department of Public Works. These contracts cover work which will cost \$3,521,700, much of which has already been completed.

A progress report on studies made by the Division for the formulation of a coordinated State-wide plan of flood control was prepared. The Division also cooperated with the U. S. Department of War and Agriculture in flood control investigations.

FLOOD CONTROL AND RECLAMATION

Maintenance clearing in the Tisdale Bypass is now being carried on by WPA labor, a crew of about 50 men being so engaged. A WPA crew of about 25 men is engaged in cleaning and hand finishing on the east levee in connection with flood damage repair work recently completed.

WPA Work Project No. 10983 was started on July 18, 1939, clearing operations in the American River flood channel. At this date approximately 170 men are at work. For the period June 25 to July 22, 1939, a total of 9,604 man-hours were engaged on Projects No. 10612 and No. 10983.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

Engineers from this office are constantly measuring diversions and return flows in the Sacramento and San Joaquin Valleys and maintaining rigid supervision over all diversions in order that as much waste as possible may be eliminated because of the extremely low flows prevailing this season.

Meetings of water users have been held at various points in the territory and the water shortage brought to their attention. Their aid has been enlisted to help in the conservation work and so far the response from the water users has been excellent. It is estimated that at this time had it not been for the work of this office and the local water users' committees, the flow into the Delta would have been approximately 350 second-feet less than at present. This increased flow has been sufficient to keep the salt water from encroaching on an additional 50,000 acres.

At present about 50,000 acres in the Delta area are affected due to water with a salinity content greater than 100 parts of chloride per 100,000 parts of water. It is expected that the Sacramento River will increase in

flow beginning about August 15th when it is anticipated that rice water now impounded in the fields will be returned to the stream channels.

During the past week a 250-mile trip through the Delta area was made by representatives of the upriver water users and the State Engineer's office.

IRRIGATION DISTRICTS AND DISTRICTS SECURITIES COMMISSION

Oakdale Irrigation District has completed the installation of five irrigation pumps to supplement the water supply received from Melones Reservoir on Stanislaus River. A release of 500 second feet from Hetch Hetchy Dam is being made for use of Modesto and Turlock irrigation districts.

Anderson-Cottonwood Irrigation District application was approved for a first refunding issue of bonds, in the amount of \$333,000 for certification by the State Controller. East Contra Costa Irrigation District petition was approved for an agreement with Bank of America to borrow \$45,000 to buy some of its own outstanding bonds.

SUPERVISION OF DAMS

Applications have been received for approval of plans and specifications for the construction of J. V. deLaveaga Dam in San Benito County and Independence Dam in Sierra County and for the repair or alteration of the Martin and Huot Dam in Sacramento County, Lake Spaulding Dam in Nevada County, Ross Reservoir in Calaveras County, Union Reservoir in Alpine County, San Dieguito Dam in San Diego County and Lower Blue Lake Dam in Alpine County.

WATER RIGHTS

During the month there were 52 applications filed, some of the more important of which are Application 9601 by James E. Collins of Los Angeles for the appropriation of 100 cubic feet per second from North Fork of Smith River in Del Norte County for the generation of power; Application 9614 by the McGeachin Placer Gold Mining Company, Sacramento, for 190 cubic feet per second and 2200 acre feet per annum storage from Humbug Creek and Shirttail Canyon in Placer County for mining purposes; Application 9621 by San Juan Gold Company of Downieville for 4,000 acre feet per annum storage from South Fork of Poorman Creek in Nevada County for mining purposes.



One of the spacious parking areas at interesting view points on the reconstructed Blue Lakes Highway in Lake County.

Lakes Highway Reconstructed

(Continued from page 5)

change the line so that the road could be constructed on a more solid foundation.

All of the embankments have now been in place for several months, and there is no evidence of settlement.

Another interesting feature of the construction was the occurrence and treatment of a large slide that occurred between Station 113 and Station 117 following a period of heavy rainfall that had lasted for several days. The slide occurred on a definite "slip-plane" of blue clay that was saturated with water from several small springs.

About 18,000 cubic yards of material were removed from this slide, and a trench was excavated to the depth of the "slip-plane" alongside the road; underdrains were placed; and the trench was backfilled with coarse rock. No further movement of the sidehill has been observed.

Every effort was made during construction to maintain the natural rustic beauty of the lake shores.

J. L. Conner & Sons were the contractors, and C. M. Butts was Resident Engineer.

Santa Monica Grade Separation Project Solves Coast Problem

(Continued from page 7)

Avenue bridge and over an extension of the existing tunnel to connect with the Roosevelt Highway about 850 feet northerly of Colorado Avenue. Other short road connections will be made between this ramp and Ocean Avenue along each side of the bridge structure.

The City of Santa Monica has received approval of a U. S. Public Works Administration grant of \$199,387 toward the construction of the grade separation at Colorado Avenue and Route 163 as far south as Bicknell Street. This grant includes part of the costs of engineering and acquiring rights of way. The State and the county of Los Angeles are contributing toward the cost of construction and engineering. The city of Santa Monica is furnishing the balance of the cost of acquiring rights of way from the gas tax accruing to the city.

Plans have been prepared and construction engineering inspection will be handled by State forces. All contracts are being awarded by the city of Santa Monica. The State is co-

operating with the city in acquiring the necessary rights of way.

Construction work accomplished to date includes the improvement of Ocean Avenue from Colorado Avenue to Pico Boulevard and some work on retaining walls which are part of the Colorado Avenue grade separation project, but which were let to separate contract.

The Ocean Avenue contract from Colorado Avenue to Pico Boulevard, which is 0.34 mile in length, consisted of widening to 84 feet between curbs and resurfacing, the plans for said work having been prepared by City Engineer Howard B. Carter. Bids for the Colorado Avenue structure and connecting roads were opened by the city on July 5, 1939, the low bid being \$196,744.

Terms of the PWA grant provide that all work in connection with the project must be completed by April, 1940.

The Colorado Avenue grade separation structure will cost in the neighborhood of \$200,000.

Highway Bids and Awards for the Months of June-July, 1939

BIDS AND AWARDS FOR JUNE

LOS ANGELES COUNTY—On Arroyo Seco Parkway between Avenue 50 and Avenue 58, four bridges to be constructed and approaches thereto surfaced with portland cement concrete, asphalt concrete and plant-mixed surfacing and about 0.6 mile of roadway to be graded and paved with portland cement concrete and asphalt concrete. District VII, Route 205, Section L.A. United Concrete Pipe Corp., Los Angeles, \$199,342; Mitty Bros. Construction Co., Los Angeles, \$200,328; Radich & Brown, Burbank, \$204,023; Contracting Engineers Co., Los Angeles, \$205,633; Griffith Co., Los Angeles, \$209,203; J. S. Metzger & Son, Los Angeles, \$211,543; W. E. Hall Co., Alhambra, \$213,506; Carlo Bongiovanni, Hollywood, \$214,999; Byerts & Dunn, Los Angeles, \$215,846; Daley Corporation, San Diego, \$223,052; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$230,753. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$191,601.20.

LOS ANGELES COUNTY—Between Anaheim-Telegraph Road and Rivera, 1.0 mile, shoulders to be widened and surfaced with plant-mixed surfacing, and portions of existing pavement to be resurfaced with asphalt concrete. District VII, Route 168, Section B. Griffith Co., Los Angeles, \$7,072; W. E. Hall Company, Alhambra, \$7,855; S. Edmondson & Sons, Los Angeles, \$8,291; Oswald Bros., Los Angeles, \$8,481. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$6,793.50.

RIVERSIDE AND SAN BERNARDINO COUNTIES—Between 0.1 mile south of San Bernardino County line and Colton, about 3.0 miles to be graded and road-mix surface treatment and seal coat to be applied. District VIII, Route 43, Section C.F. Colton, S. Edmondson & Son, Los Angeles, \$71,347; Daley Corporation, San Diego, \$72,919; Basich Bros., Torrance, \$74,345; Griffith Co., Los Angeles, \$75,104; V. R. Dennis Construction Co., San Diego, \$75,245; J. E. Haddock, Ltd., Pasadena, \$75,773; United Concrete Pipe Corp., Los Angeles, \$79,262; Martin & Schmidt Contractors, Long Beach, \$81,100; Oswald Bros., Los Angeles, \$81,975; C. R. Butterfield-Kennedy Co., San Pedro, \$83,288; R. E. Hazard & Son, San Diego, \$87,065; Geo. Herz & Co., San Bernardino, \$87,682; W. E. Hall Co., Alhambra, \$88,970; A. S. Vinnell Co., Los Angeles, \$89,524. Contract awarded to Matich Bros., Elsinore, \$62,323.50.

SACRAMENTO COUNTY—Between one-half mile west of Snodgrass Slough and Glennvale, about 3.9 miles to be graded and surfaced with crusher run base and armor coat, and a timber bridge with concrete deck to be constructed. District III, Feeder road, Piazza & Huntley, San Jose, \$68,845; Caputo & Keeble, San Jose, \$69,456; Valley Construction Co., San Jose, \$69,570; Lee J. Immel, Berkeley, \$69,581; J. R. Reeves, Sacramento, \$71,016; H. Earl Parker, Marysville, \$71,521; Eaton & Smith, San Francisco, \$74,091; Heafey-Moore Co. & Frederickson & Watson Construction Co., Oakland, \$74,230; A. Teichert & Son, Inc., Sacramento, \$75,961; Pacific States Construction Co., San Francisco, \$78,466; George Pollock Co., Sacramento, \$83,165. Contract awarded to Hemstreet & Bell, Marysville, \$64,795.20.

SISKIYOU COUNTY—Between Gazelle and Yreka, about 3.7 miles, roadmix sur-

facing and seal coat to be placed. District II, Route 3, Section B. Oranges Bros., Stockton, \$9,456; Garcia Construction Co., Irvington, \$9,653; Powers and Patterson, Alturas, \$9,686; Young and Son Co., Ltd., Berkeley, \$10,410; C. F. Frederickson & Sons, Lower Lake, \$10,714; A. A. Tieslau, Berkeley, \$10,866; Lee J. Immel, Berkeley, \$11,330. Contract awarded to E. B. Bishop, Orland, \$9,385.50.

VENTURA COUNTY—Between Fillmore and Hopper Creek, about 4 miles road-mix surface treatment to be applied to shoulders and road approaches. District VII, Route 79, Section C. Basich Bros., Torrance, \$7,227; J. E. Haddock, Ltd., Pasadena, \$7,705; Griffith Co., Los Angeles, \$8,583; A. S. Vinnell Co., Alhambra, \$8,890; Matich Bros., Elsinore, \$9,170. Contract awarded to Oilfields Trucking Co., Bakersfield, \$6,589.75.

BIDS AND AWARDS FOR JULY

KERN COUNTY—Between Route 4 and Weedpatch, about 5 miles to be surfaced with plant-mix surfacing and road-mix surface treatment applied to shoulders. District VI, Route 140, Section C. Piazza & Huntley, San Jose, \$17,713; A. Teichert & Son, Inc., Sacramento, \$22,168. Contract awarded to Griffith Co., Los Angeles, \$16,782.15.

LOS ANGELES COUNTY—Between Venice Blvd. and Santa Monica city limits, about 1.2 miles to be graded and paved with asphalt concrete and portland cement concrete. District VII, Route 60, Section L.A. Oswald Bros., Los Angeles, \$102,456; J. E. Haddock, Ltd., Pasadena, \$106,553; Radich & Brown, Burbank, \$108,385; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$108,999; United Concrete Pipe Corporation, Los Angeles, \$118,846; R. M. Price, Huntington Park, \$121,183. Contract awarded to Griffith Co., Los Angeles, \$98,489.

MENDOCINO COUNTY—About 0.9 mile road-mix surfacing and seal coat. District I, Route 56, Section Major Streets, Ft. Bragg. Lee J. Immel, Berkeley, \$8,590; Spalletta & Siri, Santa Rosa, \$9,591. Contract awarded to Helwig Construction Co., Sebastopol, \$6,598.

NAPA COUNTY—At the Napa State Hospital, about 1.1 miles to be graded and surfaced with imported base material and plant-mix surfacing and curbs and sidewalks to be constructed. District IV, Napa State Hospital, Granzotto & Angelus, Walnut Creek, \$32,880; Chas. L. Harney, San Francisco, \$34,653; Lee J. Immel, Berkeley, \$35,267; Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, \$36,010; Pacific States Construction Co., San Francisco, \$36,140; Granite Construction Co., Ltd., Watsonville, \$36,267; N. M. Ball Sons, Berkeley, \$36,954; Edward A. Forde, San Anselmo, \$38,860. Contract awarded to A. G. Raich, San Francisco, \$32,237.50.

PLUMAS COUNTY—Between Greenville and Westwood Road, about 9.5 miles to be surfaced with imported borrow and road-mix surfacing. District II, Route 83, Sections B.C. C. F. Frederickson & Sons, Lower Lake, \$17,149; Oranges Bros., Stockton, \$18,325; George Pollock Co., Sacramento, \$20,573. Contract awarded to Harms Bros., Sacramento, \$16,858.

PLUMAS COUNTY—Between Beckwouth and The Buttes, about 3.7 miles to be surfaced with imported borrow and penetration oil treatment and seal coat to be

applied. District II, Route 21, Section G. Frederickson & Westbrook, Sacramento, \$12,866; Oranges Bros., Stockton, \$13,920; Garcia Construction Co., Irvington, \$14,506. Contract awarded to Harms Bros., Sacramento, \$12,771.

SANTA CLARA COUNTY—Between Gilroy and Paradise Valley Road, about 3.9 miles, retreat surfacing to be applied. District IV, Route 32, Section D. Caputo & Keeble, San Jose, \$17,806; Granite Construction Co., Ltd., Watsonville, \$18,788; Embleton-Schumacher Co., Albany, \$19,495; Pacific Truck Service, Inc., San Jose, \$19,527; Piazza & Huntley, San Jose, \$19,620; Earl W. Heple, San Jose, \$19,720; E. A. Forde, San Anselmo, \$21,480. Contract awarded to L. C. Karstedt, Watsonville, \$14,545.70.

SIESTA COUNTY—Between 2.5 miles west of Montgomery Creek and 2 miles east of Burney, about 9.9 miles, seal coat to be applied. District II, Route 28, Sections B, C, D. C. F. Frederickson & Sons, Lower Lake, \$7,527; Lee J. Immel, Berkeley, \$7,537; Hemstreet & Bell, Marysville, \$7,641; Powers & Patterson, Alturas, \$8,004; A. A. Tieslau, Berkeley, \$8,476. Contract awarded to Hayward Building Material Co., Hayward, \$6,853.50.

TEHAMA AND LASSEN COUNTIES—Between Red Bluff and Janesville, about 30.8 miles, seal coat to be applied. District II, Routes 29, 83, 86. Granite Construction Co., Ltd., Watsonville, \$26,982; C. F. Frederickson & Sons, Lower Lake, \$27,837; Lee J. Immel, Berkeley, \$27,734. Contract awarded to Hayward Building Material Co., Hayward, \$25,191.

TRINITY AND SIESTA COUNTIES—Between Weaverville and Clear Creek, about 15.2 miles, seal coat to be applied. District II, Route 20, Sections A.B. A. Lee J. Immel, Berkeley, \$10,775; C. F. Frederickson & Sons, Lower Lake, \$10,857; A. A. Tieslau, Berkeley, \$11,000; E. B. Bishop, Orland, \$11,050; Charles Kuppinger, Lakeport, \$11,270. Contract awarded to Hayward Building Material Co., Hayward, \$9,825.

STANISLAUS COUNTY—Between Modesto and Salida, about 5.5 miles, road-mix surface treatment to be applied to shoulders and plant-mix surfacing to be placed on road approaches. District X, Route 4, Section B. Oranges Bros., Stockton, \$6,067; Piazza & Huntley, San Jose, \$6,727; M. J. B. Construction Co., Stockton, \$7,002. Contract awarded to S. M. McGaw, Stockton, \$5,737.50.

TULARE COUNTY—Between Camp Nelson and Quaking Aspen Meadows, about 9.5 miles, road-mix surface treatment to be applied to existing roadbed. District VI, Route 27, Section E. Oilfields Trucking Co., Bakersfield, \$9,879; John Jurkovich, Fresno, \$9,925. Contract awarded to Basich Bros., Torrance, \$8,426.

TULARE COUNTY—Between Kansas Avenue and 3 miles west of Tulare, about 4.2 miles to be surfaced with plant-mixed surfacing. District VI, Route 134, Section A. Piazza & Huntley, San Jose, \$9,677; L. A. Briscoe, Arroyo Grande, \$11,443. Contract awarded to Union Paving Co., San Francisco, \$9,424.50.

Chief Petty Officer—The enemy are as thick as peas. What shall we do?

Officer of the Deck—Shell them, you idiot, shell them.

State of California

CULBERT L. OLSON, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

FRANK W. CLARK, Director of Public Works

CALIFORNIA HIGHWAY COMMISSION

LAWRENCE BARRETT, Chairman, San Francisco

LENER W. NIELSEN, Fresno

AMERIGO BOZZANI, Los Angeles

BERT L. VAUGHN, Jacumba

L. G. HITCHCOCK, Santa Rosa

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G. T. McCOY, Assistant State Highway Engineer

J. G. STANDLEY, Principal Assistant Engineer

R. H. WILSON, Office Engineer

T. E. STANTON, Materials and Research Engineer

FRED J. GRUMM, Engineer of Surveys and Plans

R. M. GILLIS, Construction Engineer

T. H. DENNIS, Maintenance Engineer

F. W. PANHORST, Bridge Engineer

L. V. CAMPBELL, Engineer of City and Cooperative Projects

R. H. STALNAKER, Equipment Engineer

J. W. VICKREY, Safety Engineer

E. R. HIGGINS, Comptroller

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F. W. HASELWOOD, District II, Redding

CHARLES H. WHITMORE, District III, Marysville

JNO. H. SKEGGS, District IV, San Francisco

L. H. GIBSON, District V, San Luis Obispo

E. T. SCOTT, District VI, Fresno

S. V. CORTELYOU, District VII, Los Angeles

E. Q. SULLIVAN, District VIII, San Bernardino

S. W. LOWDEN (Acting), District IX, Bishop

R. E. PIERCE, District X, Stockton

E. E. WALLACE, District XI, San Diego

SAN FRANCISCO-OAKLAND BAY BRIDGE

GLENN B. WOODRUFF, Principal Bridge Engineer

RALPH A. TUDOR, Senior Bridge Engineer
in Charge of Maintenance and Operation

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A. D. EDMONSTON, Deputy in Charge Water
Resources Investigation

R. L. JONES, Deputy in Charge Flood Control and Reclamation

GEORGE W. HAWLEY, Deputy in Charge Dams

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C. H. KROMER, Principal Structural Engineer

CARLETON PIERSON, Supervising Specification Writer

J. W. DUTTON, Principal Engineer, General Construction

W. H. ROCKINGHAM, Principal Mechanical and Electrical
Engineer

C. E. BERG, Supervising Estimator of Building Construction

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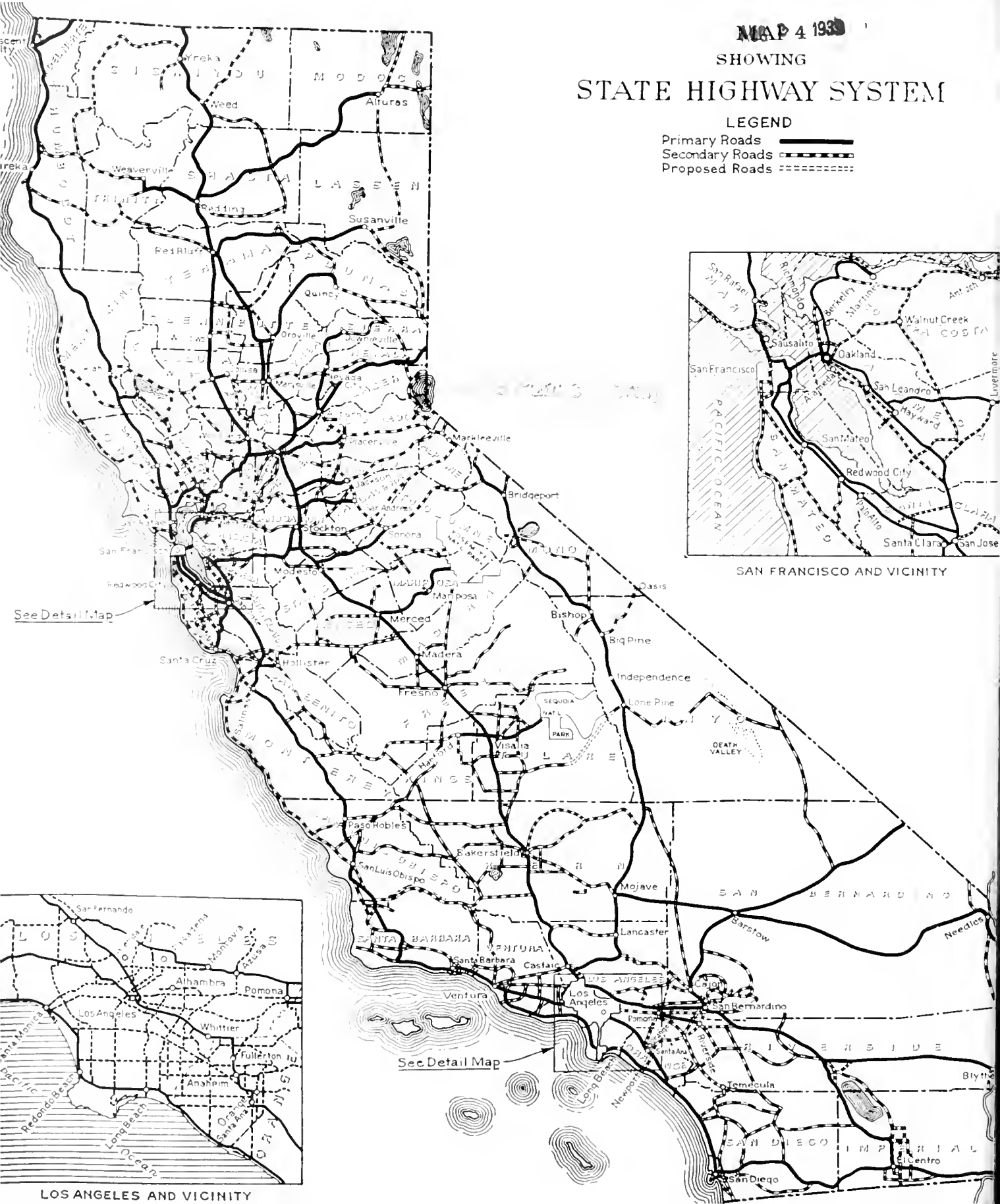
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Secondary Roads - - - - -
Proposed Roads
.....



CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



TUNNEL CONSTRUCTION BY THE CALIFORNIA HIGHWAY DEPARTMENT
HIGHWAY APPROACH TO THE TUNNEL THROUGH PRESIDIO IN SAN FRANCISCO

SEPTEMBER
1939

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

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87 Bridges Replaced, Eliminated or Strengthened on Mendocino Coast Area Highways

By E. L. WALSH, Associate Bridge Engineer

WHEN, in August, 1933, as provided by Senate Bill No. 563, an additional 6,780 miles of road were added to the State Highway System, a heavy burden of maintenance and reconstruction was placed on the Division of Highways.

One section of highway which has presented a difficult problem is the coast road (State Highway 56) from Jenner to Westport along the northern Mendocino County coast. The roadway surface was in poor condition and practically all of the bridges were badly in need of repair.

A thorough engineering investigation of each of the bridges revealed that the majority of them were not safe for legal loads. In the section from the south Mendocino County line at the Gualala River to Westport, a distance of 81 miles, there were 84 timber bridges with a combined length of 16,812 lineal feet. Only five of them were capable of supporting legal loads.

A large percentage of these bridges were constructed previous to 1910; at least ten of the bridges were constructed before 1900; and one, the Dark Gulch Bridge, was built in 1874. These bridges were designed to support a six-horse team with a loaded wagon, a load far below the required capacity of modern traffic.

Several of the structures were found to be in such poor structural condition that the cost of making adequate repairs would practically amount to the cost of complete renewal. Most of the structures were narrow, ranging in width from 10 feet to 23 feet, the majority being 14 or 15 feet wide. These bridges were not designed for modern heavily-loaded, fast-traveling vehicles, and in most cases the width of roadway and poor alignment of approaches made them hazardous for present day traffic.

The structures, built when the

Friant Dam Bids

As this issue goes to press the opening of bids for construction of Friant Dam, scheduled for September 7th, has been deferred to September 14th. The U. S. Bureau of Reclamation announced that the bids were returned to bidders unopened when at the last hour the Department of the Interior was notified by the Department of Labor that a revision of certain wage rates listed in the specifications was necessary.

Commissioner of Reclamation John C. Page, on a visit to the Central Valley Project from Washington, D. C., announced that the Bureau of Reclamation immediately would issue an addendum to the Friant specifications, listing the revised wage rates and setting an early date for a new bid opening.

The minimum wage changes, communicated by the Department of Labor, involved seven of the 123 labor classifications in the Friant Dam specifications. Under the Davis-Bacon Act, the Department of the Interior is required to include in the specifications the wage rates determined by the Department of Labor. The scale thus established must be the minimum paid by contractors on project construction.

Mr. Page said that despite the postponement the Bureau of Reclamation will make every effort to avoid any delay in an award of contract.

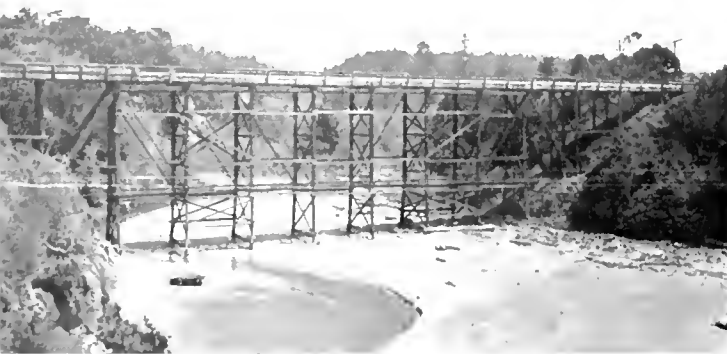
road was lightly traveled, have faithfully and economically served their purpose; but since the change in traffic conditions they have become definite hazards.

Every effort has been made by the Division of Highways to plan the work of improving these roads in a systematic manner consistent with the funds available, by strengthening and replacing the weak bridges, improving the surfacing, realigning, straightening and widening the dangerous sections so as to raise the maximum load capacity of the highway.

Because of the obvious impossibility of reconstructing all of these substandard bridges, it has been necessary to remedy the condition by various other means. In certain instances, it has been possible to repair the structures by strengthening members, placing supplementary supports, rebuilding the floor systems and making other repairs of a temporary nature in order that the load capacity of the bridges could be increased.

The problem of eliminating these substandard bridges in order to remove the restricted load postings as quickly as possible has been given serious thought by the engineers of the Highway Department. In many cases it has been possible to eliminate a dangerous structure by realigning the highway and replacing the bridge by a culvert.

Where it has been necessary to replace a major structure with a new permanent-type structure, such new structure has been placed on the ultimate highway alignment. To accomplish this it has been necessary for the district engineering personnel, in cooperation with the Department of Surveys and Plans, to make extensive surveys of the whole route from Jenner to Westport; to anticipate future requirements and to analyze the various possibilities be-



Old timber truss bridge across Jug Handle Creek on State Highway 56 replaced by reinforced concrete arch span at right

fore establishing the ultimate location of the whole section of highway—some portions of which may not be built for many years.

As this section of highway traverses a rugged coast and crosses many streams and canyons, the projection of the future alignment to be used as a basis for a well planned program has required considerable study.

The principal industries of the Fort Bragg area, located about 160 miles north of San Francisco, are lumber and fishing. There is a railroad connecting Fort Bragg with Willits on the Redwood Highway, U. S. 101. This, of course, does not serve the lumber mills located south of Fort Bragg and at Westport nor towns like Point Arena, Greenwood, Albion, Casper, Mendocino City and Westport along the coast, or Boonville and the other towns along Route 48 from the Redwood Highway to the coast.

In order to remove the restrictions

imposed as soon as possible, a concentrated effort has been made first to provide an outlet from Fort Bragg and Westport via Navarro River, Boonville and Cloverdale, so that unrestricted ingress and egress will be available and legal loads can be hauled with safety.

PROGRESS OF WORK ON ROUTE 48

State Route 48, between Cloverdale on U. S. 101 in Sonoma County and the Navarro River, also contained many old, weak timber bridges on poor alignment which imposed a definite restriction on the hauling of supplies to this area. Prior to 1937, approximately 20 miles of this route had been improved and brought up to acceptable standards.

In April, 1938, a contract was completed which covered the realignment of 1.2 miles of road and included the construction of a bridge across Dry Creek, located 13 miles northwest of Cloverdale. The total

cost of this project was \$33,000.

At the present time, there is under construction 6.25 miles of highway in portions between Navarro River and Maple Creek. Nine old bridges which were substandard and not safe for legal loads are being replaced with culverts. In addition, four of the bridges—over Ornbaun Creek, Con Creek, Robinson Creek and Maple Creek—are being reconstructed on improved alignment. The total cost of this project will be about \$220,000, of which \$45,000 will be for new bridges.

On July 26, 1939, bids were received for the reconstruction of Shearing Creek Bridge and one-half mile of road work. This project is located six miles south of Boonville. It is estimated that this project will cost about \$33,000, of which \$20,000 is for the new bridge which will replace the existing substandard structure.

The road between Cloverdale and Fort Bragg, a distance of 80 miles, has had a constant increase in travel,



The old timber bridge across Elk Creek with sharp left turn approach was replaced by concrete girder bridge on new alignment.

particularly in trucking. The several small towns and lumber camps located along the route have no other means of getting in their supplies.

Four years ago, there were 23 bridge structures on the road from Cloverdale to the junction of the coast road, 17 of which were posted for restricted load and speed. These bridges were in a very dangerous condition. Eleven of these have been replaced with culverts and fills on improved alignment and grade, at a cost of approximately \$200,000. Four structures have been replaced with new bridges on improved alignment and grade at a cost, including the grading, of approximately \$83,000. Funds have been budgeted for the replacement of the Lazy Creek Bridge with a culvert and fill on new alignment. This work is planned for construction during 1940.

NEW STRUCTURES ON COAST ROAD

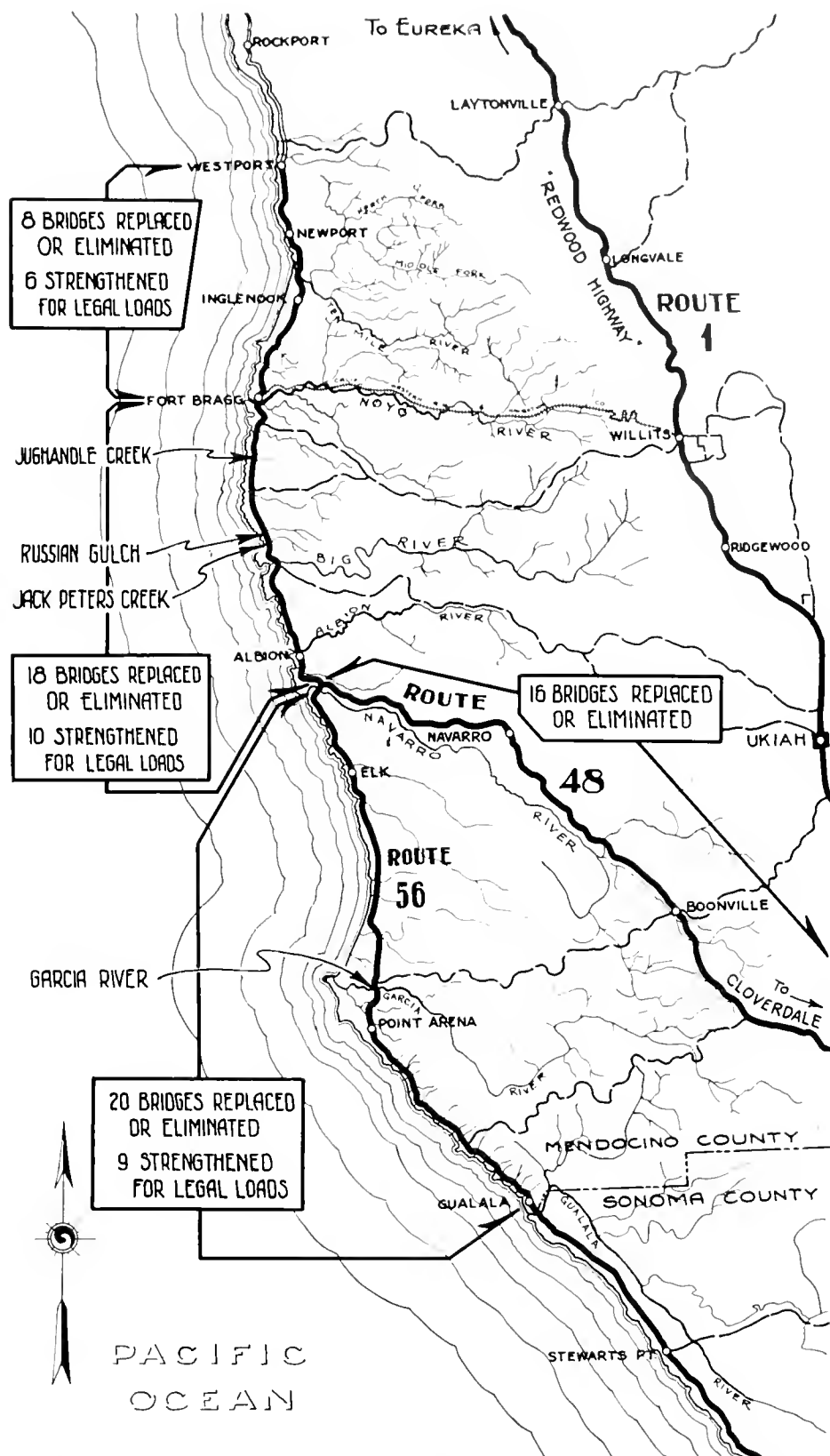
The following are some of the major structures which have been built since the State took over the coast road or which are contemplated for construction in the near future:

The Garcia River Bridge, located on the Coast Route, 45 miles south of Fort Bragg, is a steel truss and steel stringer structure 320 feet long with a 24-foot roadway. This bridge was completed in April, 1938, at a cost of \$45,000 and replaced an old timber structure which was built in 1907.

The Elk Creek Bridge, located on the Coast Route 32 miles south of Fort Bragg, is 122 feet long with 26-foot roadway and consists of reinforced concrete girder spans on concrete piers. It was completed in May, 1938, at a cost of \$16,600 and replaces an old timber structure built by the county many years ago.

The Jack Peters Creek Bridge, located on the Coast Route 10 miles south of Fort Bragg, was completed in August, 1939, at a cost of \$36,000. This structure is a reinforced concrete bridge of the box girder type. It is 233 feet long and has a 26-foot roadway. This structure, costing \$36,000, replaces an old timber truss and trestle bridge which had reached the end of its economic life.

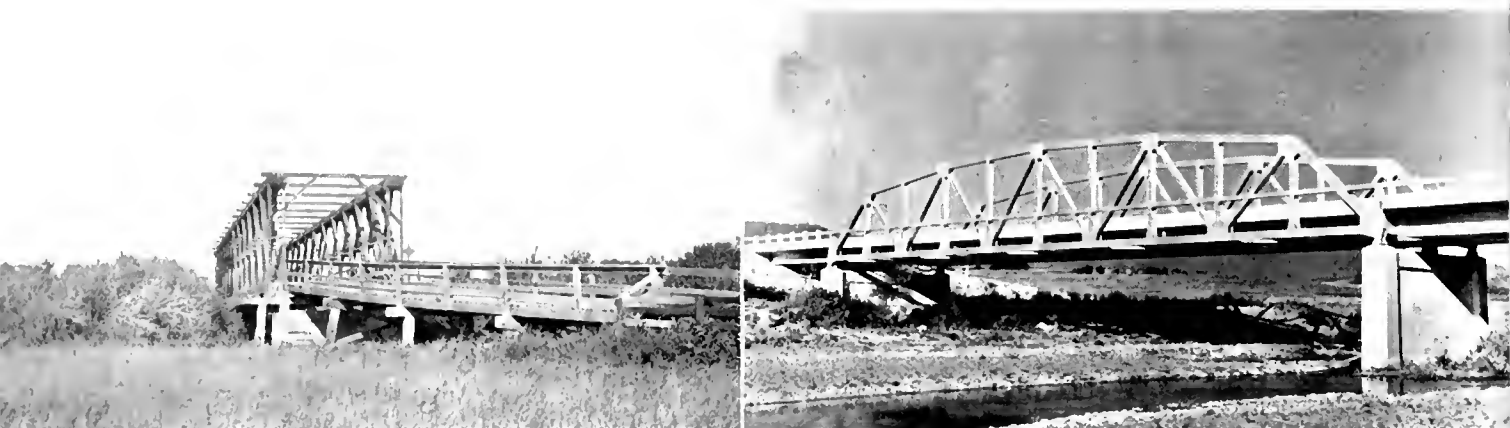
Bids were received on September 13th for a new bridge across Russian Gulch, located nine miles south of



Map showing locations of bridge improvements on Mendocino coast area highways.

Fort Bragg. This structure will be a reinforced concrete arch bridge with a central span of 240 feet. This combined with concrete girder ap-

proach spans will aggregate a total length of 530 feet. The bridge will have a 26-foot roadway and will cost approximately \$115,000. The present



Ancient Garcia River bridge with timber trusses and approaches replaced by 120 foot steel truss span with steel beam approaches.

timber truss and timber trestle bridge was built 29 years ago by Mendocino County.

The Jughandle Creek Bridge, located five miles south of Fort Bragg, is a reinforced concrete arch structure having a central span of 210 feet. Including the concrete girder approach spans, it has a total length of 388 feet and a roadway width of 26 feet. This structure was completed in August, 1938, at a cost of \$56,000. It replaced an old timber truss and trestle structure built by Mendocino County in 1888.

Of the 84 bridges on the Mendocino coast between the Gualala River and Westport, 35 have already been replaced with culverts and fills at a cost of approximately \$142,000. Of this amount, \$70,000 was spent north of the mouth of the Navarro River.

Six structures have been replaced with new bridges on improved alignment and grade at a total cost of approximately \$200,000. Of this amount \$100,000 was spent north of the mouth of the Navarro River.

Twenty-five structures have been strengthened for legal loads at a cost of approximately \$200,000, of which \$140,000 was spent between the Navarro River and Westport.

It is planned to strengthen seven weak structures south of the Navarro River during the present biennium. It is estimated that the work will cost \$24,000.

Four structures located south of the Navarro River are now being replaced by culverts and fills at a total cost of \$76,000.

As soon as funds are available, it will be necessary to completely replace the Schooner Gulch Bridge and the Alder Creek Bridge at a cost of \$100,000 and eliminate four weak structures by replacing them with culverts and fills at an estimated cost of \$50,000. Several of the large timber bridges have been strengthened and repaired so that it is expected that they will be able to carry legal loads for several more years. At the end of that time it will be necessary to rebuild them completely.

Many of these bridges such as the Albion River and Ten Mile River bridges are major structures, the replacement of which, including the line change and road approach will involve considerable expenditure. As an example, the replacement of the Albion River Bridge on proper alignment is likely to cost \$300,000.

To date over \$1,000,000 has been spent in this area to increase the load capacity of the roads. After the bridges across Russian Gulch and Shearing Creek have been completed and the Lazy Creek Bridge has been eliminated by realignment, the entire road from Cloverdale to Fort Bragg will be safe for legal loads.

Office Boy (nervously)—"Please, sir, I think you're wanted on the telephone."

Boss—"You think! Aren't you sure?"

Office Boy—"Well, the voice at the other end said: 'Hello, is that you, you old idiot?'"—*Boston Transcript*.

Teacher—"What can you tell me of America's foreign relations?"

Student—"They're all broke."



Timber truss bridge, frequently strengthened across Jack Peters Creek replaced by modern concrete box girder span

Division of Architecture Program Totals \$12,298,288 for Biennium

By W. K. DANIELS, Assistant State Architect in Charge

LOOKING toward the work at the present time confronting the Division of Architecture of the Department of Public Works for the current biennium, there is a total of \$12,298,288 available for construction, improvements, and equipment for the various state institutions and departments.

Some of the outstanding projects listed for this biennium include the Acute Psychiatric Hospital Unit to be constructed for the Department of Institutions to be operated in conjunction with the University of California Hospital in San Francisco; the starting of the erection of new state colleges at Santa Barbara and San Francisco; the construction of the Southern California State Prison for first offenders at Chino; and, although of comparatively small cost but nevertheless outstanding, due to the disturbance of old walls and fixtures, the alteration and modernizing of the Governor's office in the State Capitol at Sacramento.

Available State funds for construction, improvements, and equipment for the biennium are listed as follows:

Agnews State Hospital	\$89,650
Acute Psychiatric Hospital, San Francisco	500,000
California Polytechnic School	131,000
California School for Blind	68,000
California School for Deaf	151,300
California National Guard	102,974
Camarillo State Hospital	2,781,460
Chico State College	30,075
Department of Agriculture	60,830
Department of Public Health, Berkeley	10,000
Division of Parks	60,000
Fish and Game Commission	138,600
Folsom State Prison	110,000
Forty-fourth District Agricultural Association, Colusa	19,000



W. K. DANIELS

Fresno State College	180,000
Highway Maintenance Station, Ojai	14,400
Highway District Office Building, Los Angeles	300,000
Humboldt State College	223,390
Industrial Home for Adult Blind	3,500
Mendocino State Hospital	561,625
Napa State Hospital	309,500
Norwalk State Hospital	198,900
Pacific Colony	75,335
Patton State Hospital	216,850
Preston School of Industry	400,050
San Diego State College	303,500
San Francisco State College	415,000
San Jose State College	293,500
San Quentin State Prison	274,900
Santa Barbara State College	567,000
Sonoma State Home	209,440
Southern California State Prison, Chino	1,682,579

Sixth District Agricultural Association, Los Angeles	9,550
State Buildings, Improvements at Sacramento, San Francisco and Los Angeles	397,991
State Narcotic Hospital	150,000
Stockton State Hospital	661,000
Sutter's Fort, Sacramento	30,000
Third District Agricultural Association, Chico	6,500
Ventura School for Girls	12,800
Veterans' Home	470,439
Whittier State School	67,650
Woman's Relief Corps Home	10,000
Total	\$12,298,288

The Division of Architecture has been functioning since 1907—32 years—and is the agency through which all the obligations of the Department of Public Works, in connection with State institutions and departments, are discharged.

SUPERVISES SCHOOL CONSTRUCTION

The Division is also vested with authority under the police power of the State and directed to supervise the construction of all new school buildings, the reconstruction, alteration of or addition to all school buildings used for elementary, secondary or junior college school purposes.

The word "architecture" might lead one to assume the Division's time is devoted to designing and planning structures of a classical or monumental character. On the contrary the State's buildings are now designed with maximum simplicity, economy, practicability and efficiency being borne in mind at all times.

The duties and activities of the Division cover a wide field which we daresay is not generally realized.

In addition to designing, planning, and constructing buildings of every nature to meet the diversified require-

(Continued on page 21)

Pacheco Pass Realignment Job Completed Abolishing 31 Curves

By H. S. PAYSON, Resident Engineer

THE realigned section of State Highway Route 152 on the historic Pacheco Pass in Santa Clara County was opened to travel without any formalities on August 8th. The final cleanup was completed on August 12, with only 229 working days used of the 270 working days allotted for the construction of the 2.6 miles of heavy work eliminating 31 curves on the old road.

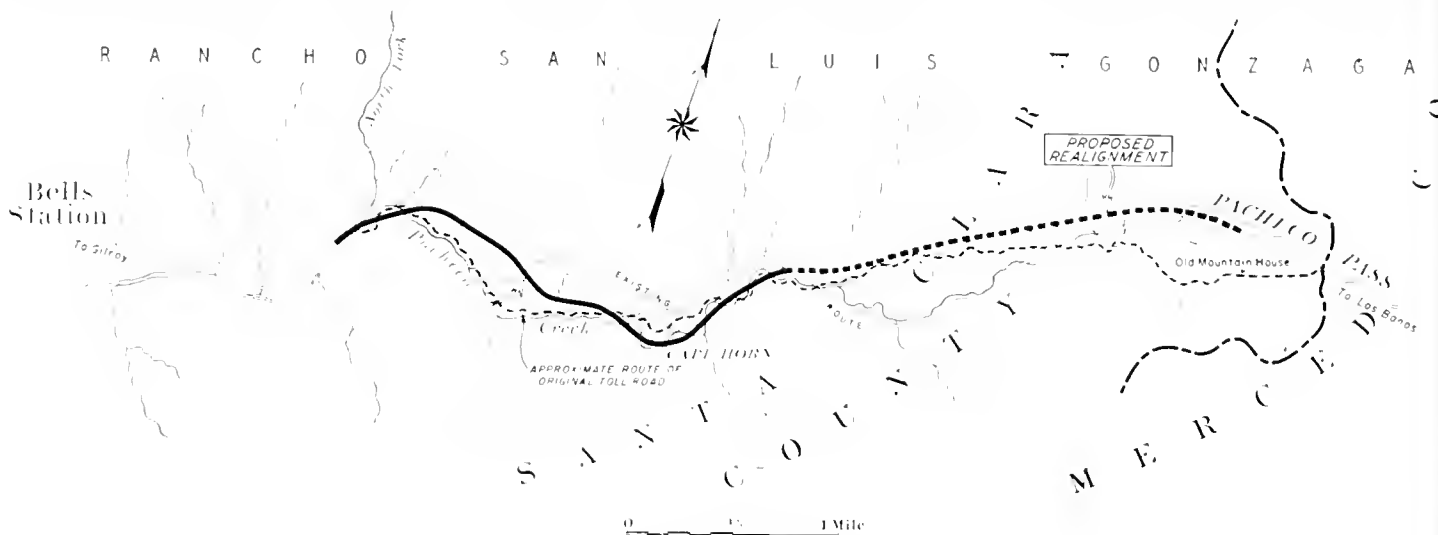
The contract was awarded to Granfield, Farrar & Carlin of San Francisco on November 7, 1938, and

improvement, distance saving and other comparative data, was constructed on entirely new alignment. This had both advantages and disadvantages. The contractor was not hindered in his work by the heavy traffic using the route, but was handicapped to some extent due to inaccessibility of structure locations, particularly on some of the concrete arch culverts.

At one of these locations it would have proven quite expensive and difficult to construct an access road to deliver the concrete aggregate to

consisting of two 20 cubic yard, six 18 cubic yard, and four 14 cubic yard units. In addition there were six bulldozers which were used to spread and compact fills, construct pioneer roads and as boosters for the carryalls during loading.

Six heavy duty scarifiers were also in operation to loosen the excavation for more rapid loading. Five power shovels and fifteen dump trucks completed the dirt moving equipment, and when fully operating moved in excess of one hundred fifty thousand cubic yards per



Heavy black line shows completed sections of Pacheco Pass realignment. Dotted line indicates proposed continuation of improvement when funds are available.

work was started on that date. In establishing the time limit for the work it was expected that inclement weather during the winter would require cessation of work for a two-month period. However, the season was so mild that only four days were sufficiently severe to stop the work, and the completed project was made available for public travel almost two months sooner than anticipated.

This project, which was described in the February, 1939, issue of "California Highways and Public Works" as to location, type of im-

the site of the work. To obviate this situation the mixer was placed adjacent to the existing road, water from the creek was pumped to the mixer and the mixed concrete was conveyed by chutes to the forms, some two hundred feet down a steep slope.

The principal item of the contract involved moving approximately 600,000 cubic yards of excavation. The major portion of this work was accomplished with tractors and carryalls. During the period when the dirt was really flying, there were twelve carryalls in operation,

month. In spite of the heavy equipment the contractor used four carloads of dynamite to loosen the material and facilitate the work of the equipment.

In addition to the large amount of excavation, the project also included two reinforced concrete bridges crossing Pacheco Creek and the South Fork of Pacheco Creek, of continuous girder design and respectively 215 feet and 136.25 feet in length.

The completion of this new section eliminates the portion of the route where the heaviest grades and sharp-

est curvature prevailed. The saving of .81 of a mile in the 2.6 miles of the project is not indicative of the time saving. The reduced curvature, increased sight distance, increase in minimum radii and reduced gradient will be conducive to more rapid and pleasant travel on the lateral highway connecting the Bay area arterials and the lower San Joaquin Valley.

As an added feature of safety and convenience, the traveled way has been paved to provide a four-lane roadway in the vicinity of Station 155 where sight distance is limited due to curvature and a high bank on the inside of the curve.

The great benefit gained by this alignment may best be visualized by comparing the standards of the old with the new.

Old Highway

Length.....	3.46 miles
Total curvature.....	2,313 degrees
No. of curves.....	39
Minimum radius.....	100 feet
Maximum grade.....	7 per cent

New Highway

Length.....	2.63 miles
Total curvature.....	295 degrees
No. of curves.....	8
Minimum radius.....	850 feet
Maximum grade.....	6½ per cent

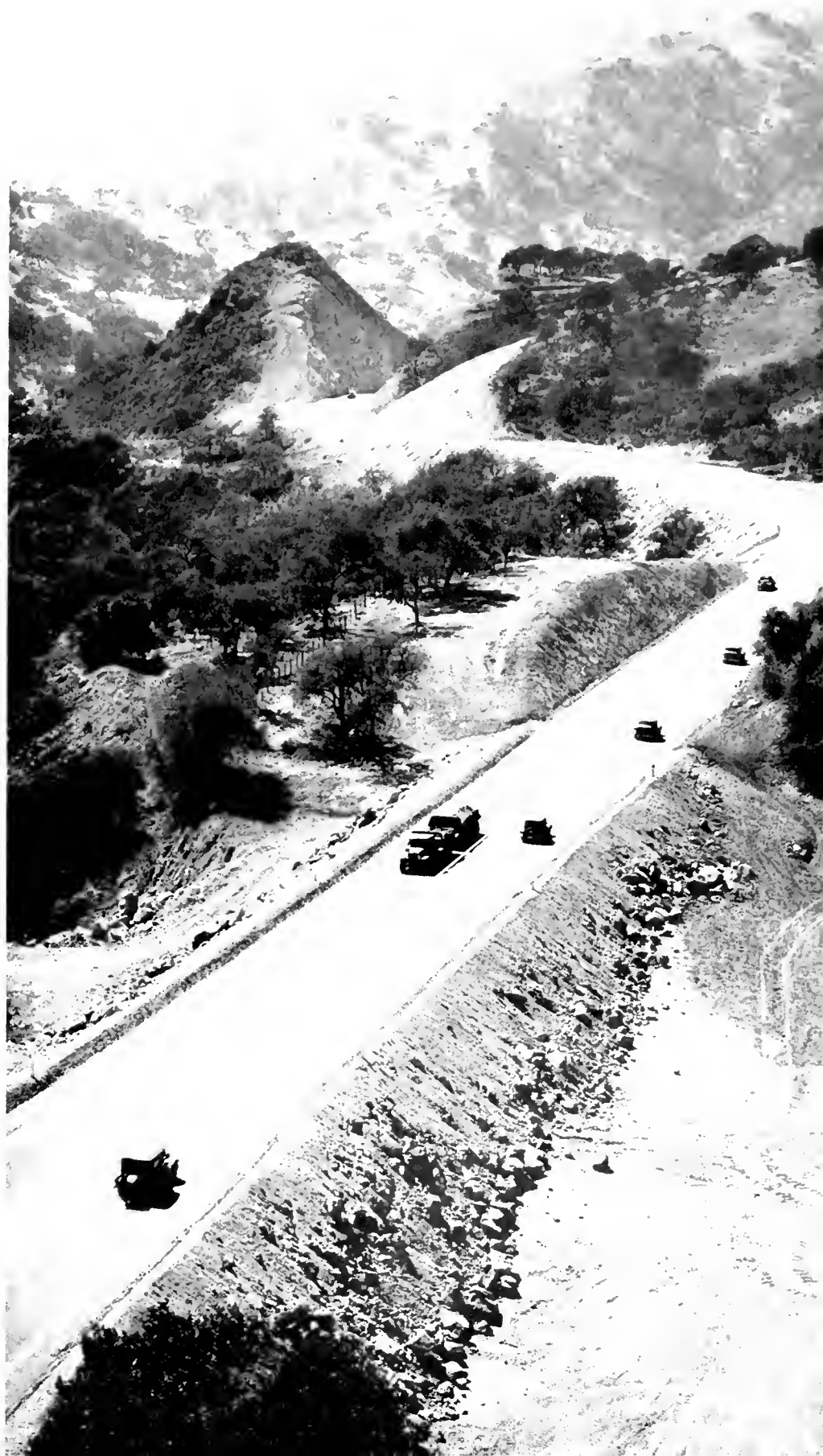
Most Auto Mileage on State Highways

Motor vehicles in the United States travel 250 billion miles each year, an average of 8870 miles per vehicle, according to an official report.

The average vehicle, according to the State Highway Planning Survey, traveled 5000 miles last year on primary rural State highways, 1190 miles on secondary State highways and local rural roads, and 2680 miles on city streets. However, there was wide variation in use of the different classes of highways by urban and rural residents.

Vehicles owned in small towns were used principally outside of cities while residents of cities did more than 41 per cent of their driving on city streets. All vehicles except those in the largest cities used the State primary rural highways more than all other systems.

Recently completed realignment of State Highway Sign Route 152 through Pacheco Pass in Santa Clara County.





Huge rotating dome of Palomar observatory for 200-inch telescope is 135 feet in diameter. The aperture is 30 feet wide.

Palomar "Highway to the Stars"

By WALTER BEUTHEL, Assistant District Highway Engineer

IN SOUTHERN CALIFORNIA is a road which is receiving constantly more attention and publicity, known as "The Highway to the Stars." It is appropriately named and of increasing importance far beyond its immediate locality. It is the road recently constructed up the south slope of Mt. Palomar, in San Diego County, to make possible the locating of an observatory on the mountain to house the largest telescope in the world.

The road may be said to begin at a point about five miles easterly from the little settlement called Rincon on Secondary State Highway 195, about 35 miles east of Oceanside. From an elevation of 2670 feet it rises by grades not exceeding 8 per cent and curves not sharper than 100-foot radius to an elevation of 5568 feet at the observatory plateau near the summit of the mountain, in a dis-

tance of about 12 miles. The road-bed width is 28 feet and the present surface is oil treatment.

In 1927, through the efforts of the late Dr. George Ellery Hale, a \$6,000,000 grant was made by the General Education Board of the Rockefeller Foundation to the California Institute of Technology, for a new observatory to include superior astronomical equipment.

With the funds thus made available it was decided to construct a telescope having a 200-inch diameter mirror, twice the size of the Mt. Wilson instrument, the largest now in use. The advantage of the new telescope will be partly in its greatly increased light concentrating power which will make possible the photographing of more remote objects and show with greater detail and brightness known stars and nebulae.

Technical and mechanical progress

of recent years will also make possible greater stability of the large parts necessary. Temperature control of the huge dome, in which the instrument will operate, will contribute to its effectiveness and improved bearings and supports to its ease of control. There will be additional smaller telescopes to supplement and assist in the observations.

The site on Palomar Mountain was selected as being most favorable because of the prevalence of clear nights throughout the year, minimum of turbulence in the upper air strata and distance from interfering lights of metropolitan areas—all contributing to the quality and quantity of the observatory work.

A condition of this location was that San Diego County provide an adequate road to the observatory site to transport the materials for the several buildings, the large mirror

and large and heavy telescope parts when ready for installation, and thereafter to serve as necessary access to the observatory.

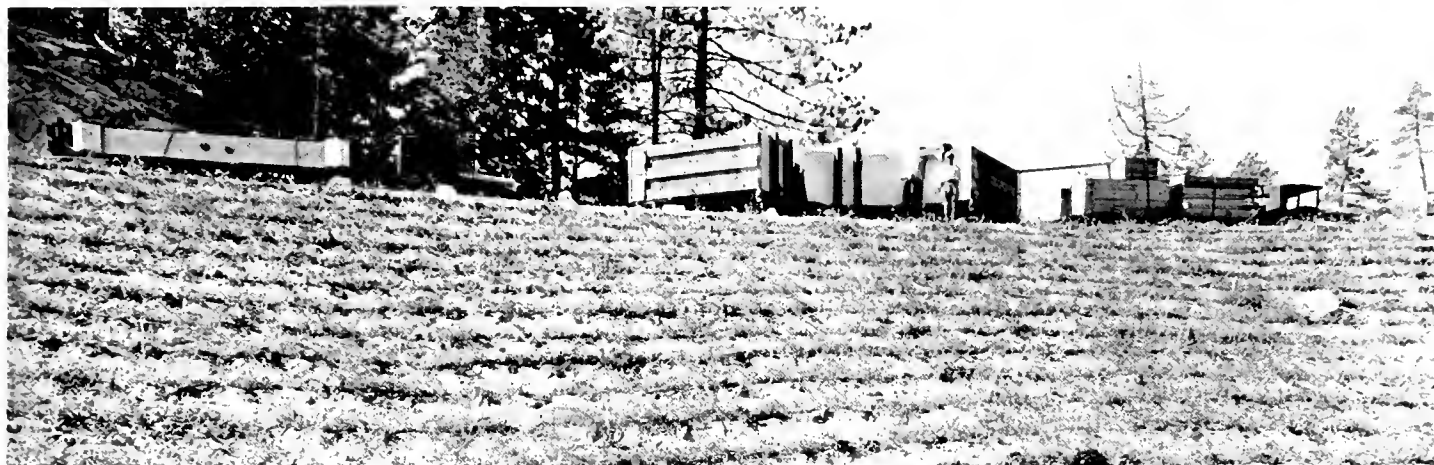
Construction of the road was undertaken in several units by State and county forces and with funds provided by the State, Federal Government and the county.

Old roads or more properly trails existed up the east and south slopes of the mountain but these narrow roads with their steep grades, sharp curves and poor alignment were not feasible even for improvement and were discarded for a new location up the south slope.

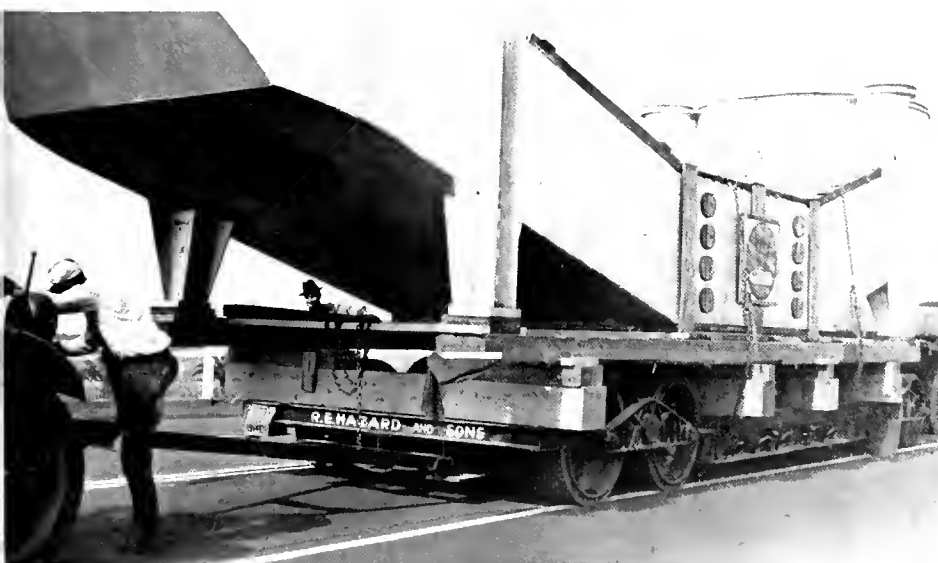
Late in 1934, when the design of the 200-inch mirror instrument was being completed, the matter of transportation of the parts was carefully considered by the designers and those



Transporting telescope parts over State Highways to Palomar Mountain.



Heavy loads on mountain grade. Center is part of telescope horseshoe weighing 54 tons. Behind it is a large girder.



Largest parts were moved on 4-axle low bed trailer.

in charge of its construction. The moving parts of the telescope weigh about 425 tons, and it was evident that besides the division into various pieces for design reasons and manufacturing convenience, a further division of certain portions would be necessary in order to get them from factories to the remote observatory site, which is 75 miles from San Diego, the closest port. Rail haul was not feasible because of the size of the parts, and because rail branches ended over 35 miles from the site.

The California Institute of Technology, in charge of the design and erection of the observatory, referred the matter to the Division of Highways, and after consideration of routes and bridge conditions by the State, the telescope design was completed, with the heaviest piece weighing about 54 tons and the largest 22

feet in diameter and 14 feet high.

Roadbed width, gradient and curvature of standards which would make possible the use of vehicles capable of handling these loads were then considered and construction proceeded. The work was sufficiently completed in 1937 to allow safe moving of many loads of fabricated structural steel for the 135-foot diameter dome of the main building, together with other necessary materials.

In October, 1938, the metal parts of the telescope arrived at San Diego by ships from the factories on the eastern coast.

Details of the permits for the hauling were worked out on recommendations of the State authorities as the schedule of the work and the exact data on the vehicles and loads became available.

The route selected included eight bridges on State highways and two on county roads, all newer types and of recent construction. Absence of weak bridges, width of roadbed and most favorable traffic conditions were considered in the choice of route from San Diego to the beginning of the "Highway to the Stars." This 12-mile portion has the steepest grades but no large bridge structures.

As the parts were unloaded from the ship's deck at San Diego an indication of their weight was observed when the rather sizable freighter listed very apparently as each piece was hoisted from the deck by a large railroad crane.

The loads were the heaviest unloaded from a ship at San Diego and also the heaviest moved over highways in this vicinity. A large four-axle, low-bed trailer supported the greatest weights and with two large trucks pulling and another pushing on hills the trip was made to the mountain and then up "The Highway to the Stars" in about two days' time for each load.

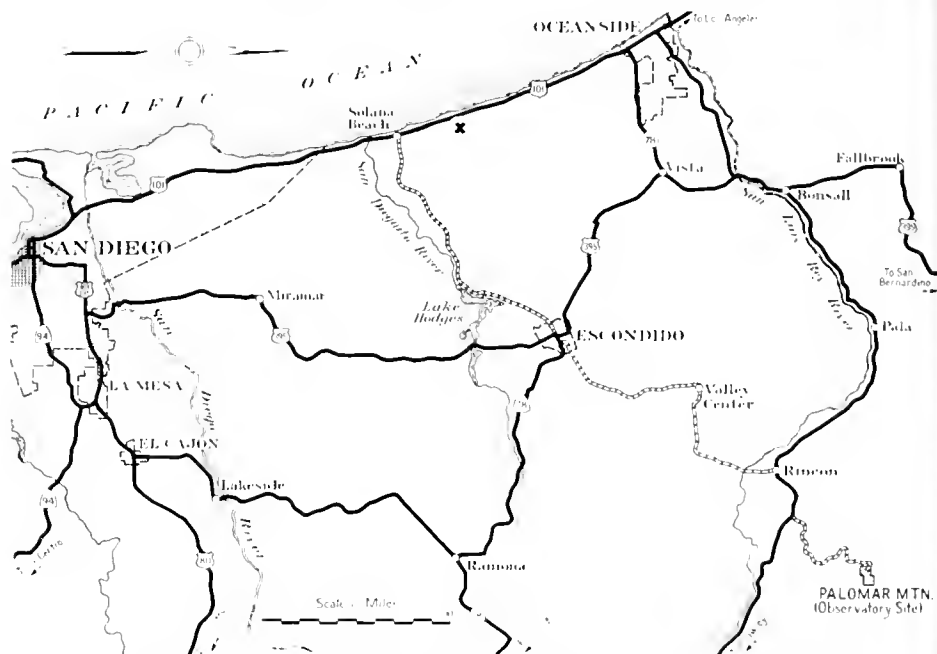
The State Bridge Department designated the definite lanes of certain bridges to be used, limited the speed, prohibited other loads on the bridges at the same time and checked the stresses as the loads crossed. The traffic was controlled through the cooperation of State and city police and the moving was accomplished without accident or noticeable damage to road surface or structures.

Road improvement projects

(Continued on page 24)



Section of new highway on Palomar mountain grade.



Map of State Highway 101(X) and County Roads (hatched) over which telescope parts were hauled from shipside at San Diego.

Observatory Site



County road to observatory site before rebuilding.

Grade Crossing Program Presents a Major Traffic-Safety Problem

By J. W. VICKREY, Safety Engineer

ROADS, highways and streets are designed, constructed and maintained for one purpose—the movement of people and their commodities.

Over a long period of time people have taxed themselves in various ways to get the money with which to provide for these public thoroughfares so as to make this movement possible. There was a time not so long ago when this movement was fairly simple and no great amount of money was required, as we think of amounts of money today. At that time we were more concerned about a road that would hold up throughout the year without too much dust and mud and inconveniences of that sort.

In later years, with the improvement of vehicles of transportation, the movement has become very complex. We now think in terms of the mass movement of hundreds of thousands of motor vehicles of all sorts, sizes, weights, and descriptions. We think of roads as highways; and a highway signifies to us a divided multiple-lane, smooth, straight boulevard. We talk of highways not in terms of road surface, dust, and mud, but in terms of vehicle miles and in carrying capacities of 1000, 2000 and 3000 cars an hour. This movement now amounts to 250 billion vehicle miles a year throughout the United States; and in California we make up not one-forty-eighth but almost one-tenth of this vast movement.

MASS MOVEMENT PROBLEM

It is not a difficult task for an average driver to drive an average car over what we think of today as an average mile of road. But multiply that simple movement by 250 billion and you do have a problem. That is the problem with which we are confronted today—to provide for the safe and orderly movement of 250 billion vehicles miles of motor vehicle travel.

The grade crossing problem in Cali-

fornia is a problem within itself; but, of far more importance, it is a portion of this greater problem.

The measure of the efficiency of a highway system, or any single unit or portion of that system, is the orderliness with which it accommodates traffic. That highway does its job the best where traffic moves quickly—with the least confusion, the least congestion, and the smallest number of collisions in terms of miles traveled. The most popular yardstick today for measuring the efficiency of a highway, and the one that can be applied the quickest, is the number of accidents that occur. In fact, it has been contended by some authorities that if a record could be compiled of all accidents, regardless of their degree of seriousness, it would be found that accident occurrence would be in direct ratio to congestion. Whether that be true or not, a better accident reporting system and time will tell. It is a fact that the greatest number of accidents occur in the areas showing heaviest traffic.

ACCIDENT FREQUENCY SYSTEM

In California we have a system by which we compare the accident situation on one section of highway with another in terms of miles traveled, and at the same time in terms of miles of road. We also compile accident data in such a way as to bring into immediate focus all points of recurring accidents—or as a statistician would say, the points of high accident frequency. By this system we are able to measure the accident frequency at each or all of the 1150 grade crossings on the State Highway System in California, not only one with the other but also with all other points of accident concentration on the State Highway System.

It is interesting to point out here that, judging from the past several years, the average main-line crossing in the State will be the scene of an ac-

cident involving a motor vehicle and a train once in about four years, and that there will be one death at this average crossing in 40 years; and further, that the hazard of a grade crossing with reference to all other points on the highway system is at the ratio of about one to sixteen. In other words, if you are going to be killed in a motor vehicle accident in California, the chances are sixteen to one that it will not occur at a grade crossing.

\$200,000 AVERAGE COST

There are, in round figures, 12,000 main- and branch-line grade crossings in California, and several thousand more crossings of side tracks, switches, etc., that get only intermittent use. Forget for the moment this latter group and consider only the 12,000 that are in daily use. The average cost of grade separation projects in California has been approximately \$200,000. This figure is, no doubt, somewhat higher than the average cost would be for separating the 12,000 main- and branch-line crossings.

No accurate figures of the cost of separating all of these crossings are available—none has been made. Our engineers, however, use a figure of \$100,000 per crossing for this purpose. The estimated cost of separating the entire group of crossings on this basis, therefore, is one billion two hundred million dollars. If the entire amount of money now available for major construction purposes on the state highway system—approximately fourteen million dollars per year—were devoted to this work alone, it would take about eighty years to do the entire job.

Or, look at it from another viewpoint—assuming that the grade separation job is a safety problem and the money expended therefor is a contribution towards safety. If we are willing to spend over a billion dollars for that job, then we should be just as willing to contribute on the same



Four lane divided highway underpass with 8-foot division strip near Redding on State Route 3 (U. S. 99) in Shasta County.

basis to relieve the traffic accident problem over the entire State. Therefore, on the basis of fatalities, comparing grade crossing accidents with all other traffic accidents, we are talking about a total expenditure in excess of seventeen billion dollars.

In order to work out a reasonable plan of procedure to be followed in improving conditions at grade crossings it is necessary to get the problem in proper focus as related to the entire traffic problem. Highway engineers attempt to measure the necessity for improvement at each of the many crossings and to set up some plan of priority so as to improve the worst crossing first, and so on in proper order, and thus obtain the most value in traffic service for each dollar expended.

VALUE OF DELAY TIME

In order to do this from a factual basis they have taken into consideration not only the accident data, which are available, of course, for several years, but also they have measured the delay to traffic in terms of vehicle minutes per day. It is readily

seen that in measuring delay in terms of vehicle minutes consideration has been given to both train and motor vehicle traffic. By placing a value on time of delay it is possible, for comparative purposes, to arrive at an economic value of separating grade crossings.

Of course, there has been much written and more said about the value of human life. Life is a very difficult thing to evaluate, and many things would necessarily have to be taken into consideration in so doing. But the value is the same whether a life is ended at a grade crossing or elsewhere; so in any comparison it is sufficient for our purpose to consider fatality totals without attempting to place a dollar value.

Again, by working up the time of traffic delay, a basis is provided for comparing grade crossings with any and all other types of intersections, and the grade crossing problem is brought more closely into focus with other traffic problems.

Many grade crossings are located in highly congested areas where values are high and right-of-way costs pro-

portionately excessive. At these locations it is usual that street systems are already laid out and abutting property established. A grade separation structure in such places would entail a drastic change in existing conditions and the use of existing streets. If several streets come together near the crossing, as is frequently the case, the problem becomes more complex and more costly.

The proposed Aliso Street Overhead in Los Angeles is an example of this sort of a crossing. The grade separation structure at this point is now being worked out, at an estimated cost of \$1,500,000. Two or three separations like that one would materially raise the average figure of \$100,000 used in a preceding paragraph.

California has already done much with this grade crossing problem. In general, we have been able to follow out an orderly plan based on an economic survey, so that many of the most hazardous crossings have already been eliminated.

In the ten-year period from January 1, 1929, to January 1, 1939, there

have been 69 separation structures constructed. The State has contributed, in round figures, \$5,750,000 toward these projects, and the several railroads have spent a little more than three-quarters of a million dollars. There is now a general trend toward the use of highway funds alone for the construction of separation structures. I quote from an article by Mr. L. H. Collett, Safety Supervisor, Coast Lines, Atchison, Topeka, and Santa Fe Railway:

"For years the American people, in general, and automobilists in particular, have passed to the railroads the responsibility for such accidents. (Mr. Collett is speaking of grade crossing accidents.) But the railroads take the position that when a public crossing is established by law, when the managements of railroads see to it that such crossings are maintained in good conditions and see to it further that proper warnings by whistle and bell are given of the approach of engines and trains—the responsibility of the railroads ceases, and that of the motoring public begins! It is worthy of mention that history does not record an instance where a locomotive has ever jumped off the rails to hit an automobile, then jumped back on the rails and went on its way."

In recent cases before the Railroad Commission that body has leaned toward a policy whereby the major cost of separation is paid from motor

vehicle users' funds. There may be justification for this trend under the existing economic condition of the railroads. The underlying principle, however, is not changed—that rights granted to the railroads do not constitute a complete severance of country or State; and that there is and always will be an obligation on the part of the railroads to provide for cross movement commensurate with the demands of that movement.

During the last four years certain funds have been made available by the Federal Government for grade separation projects. This money was allotted to the several states on the basis of railroad mileage within the State, population of the State, and Federal-aid highway mileage. In addition to eliminating hazards, one of the primary purposes of the appropriation was to furnish employment. California has received about \$11,000,000 from this source. Sixty-nine projects have been completed or are now under construction and only two projects remain to be advertised.

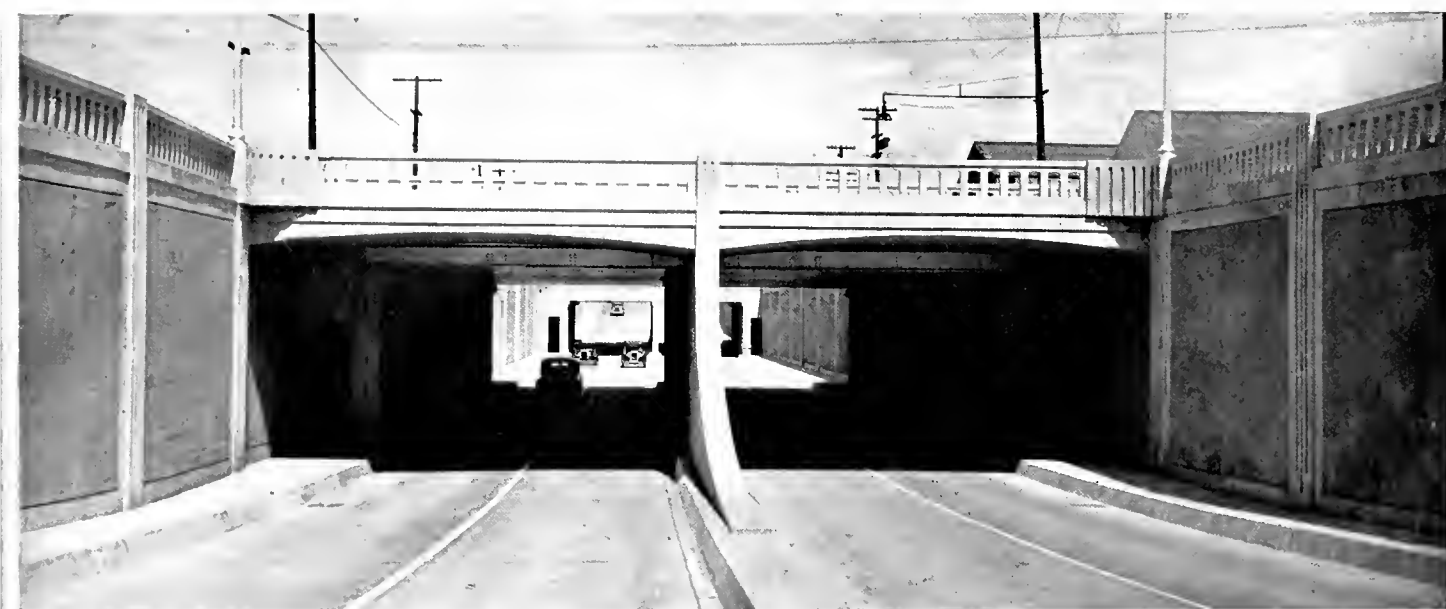
It was specifically required that the funds should be divided among the railroads on the basis of their main-line mileage operated in the State, and that they could not be used for right of way purposes. These requirements were matters of no small moment. The Great Northern Railway operates approximately one hundred miles of road through the most sparsely settled portion of the State. Under the regulations, this

mileage made it necessary to construct one grade separation project on this line, although no crossings in that area could compare in traffic with hundreds of crossings in other locations.

The Union Pacific operates only in Southern California, and the Western Pacific only in Northern California, while the Southern Pacific and the Santa Fe operate over the greater part of the State. Grade separation projects at important crossings are individually expensive; and the problem of distributing a relatively small number of projects over these various railroads and throughout the State, is provided by governmental regulations under which the allotment of these funds was made.

Obviously, it will be many years before even the most important crossings, from a traffic and traffic-safety standpoint, can be eliminated with funds that are now available. Proper consideration for the movement of traffic demands that the work go forward on a balanced and orderly basis. The Division of Highways, therefore, along with the program of separation, is at the same time carrying on a program of grade crossing protection. In carrying out this program, careful consideration is being given to all the known types of protection and a determined effort is being put forth to adapt each type of protection used to its proper place—again being guided by the broad basic principle of obtaining the maximum in service for each dollar expended.

(Continued in a later issue.)



Grade separation at Stockton carries U. S. 50 traffic on 4-lane divided highway under 8 tracks of two railroads.

Grade Crossing Overhead Project Includes 3-Span Bridge Over Stream

By M. W. GEWERTZ, Resident Engineer

THE recent completion of the Greenville Overhead Project, located on the eastern outskirts of the town of Greenville in Plumas County, marks the elimination of one more dangerous railroad grade crossing and a narrow one-way highway bridge at the same time.

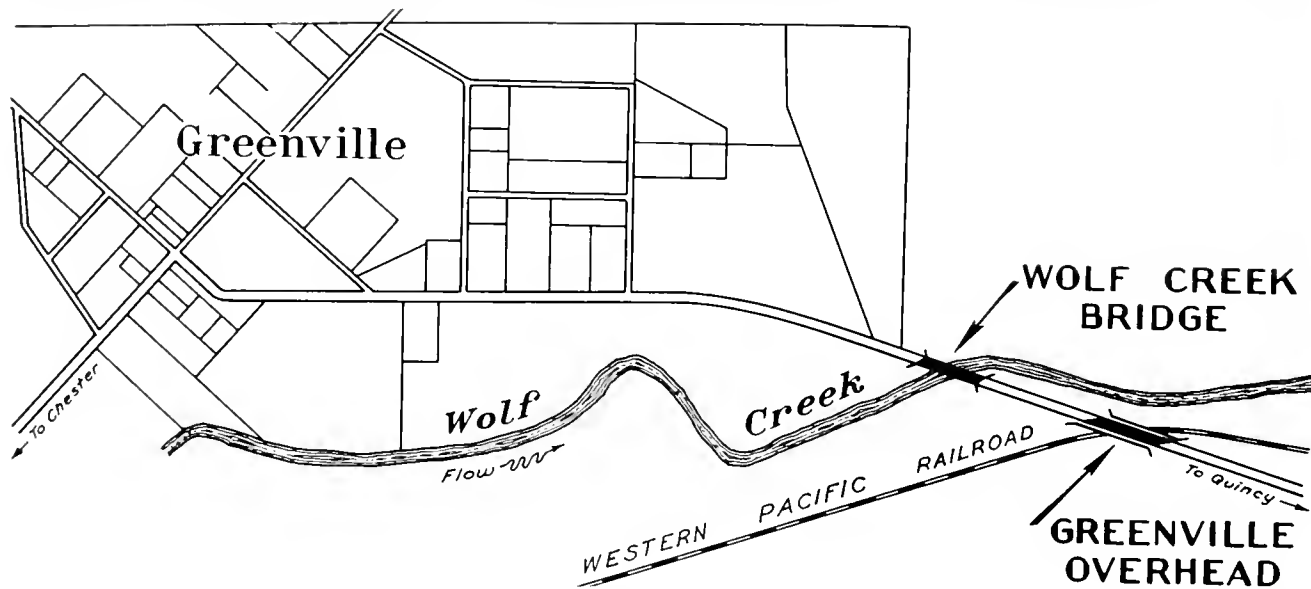
It was originally contemplated that this work be constructed as a Federal Forest Highway Project, and plans were prepared by the U. S. Bureau of Public Roads in 1935. At a later date the project was included among

The cost of the completed project is approximately \$125,000, all of which was supplied from Federal funds. Rights of way were secured with State funds.

The work consisted of the construction of two reinforced concrete and structural steel bridges: one the overhead structure across the tracks of the Western Pacific Railroad, and the other a bridge crossing Wolf Creek, which lies approximately parallel to and about 200 feet north of the railroad. Approach embankments were

feet wide. This provides a shoulder 6 feet wide on the side where the structure sidewalks are located, thus providing a passageway for pedestrians throughout the length of the project. Approximately 1000 lineal feet of laminated guard railing was placed on the shoulder opposite to the sidewalk side where the embankments are high, as an additional safety measure.

A detour approximately 1000 feet in length was constructed with a 24-foot graded roadbed and an 18-foot



those to be constructed by the State with Federal funds, and in the early part of 1938 the plans were revised by the State Highway Department. Funds were made available from the 1938-40 allocation and the construction contract was awarded in August, 1938.

The project is located on State Highway Route 83, a secondary State highway, and has made possible the elimination under one contract of the railroad grade crossing and the old one-way bridge across an adjacent stream as well as providing a material improvement in alignment.

constructed for a length of approximately 2000 feet, providing for both structures. Metal crib retaining walls were constructed to retain the approach fills adjacent to the railroad tracks.

The existing bridge across Wolf Creek, which consisted of a steel pony truss of 60-foot span and 13-foot clear roadway, was removed and the existing railroad crossing was abandoned.

A graded roadbed 31 feet in width was constructed, upon which was placed a base of 6 inches of selected gravel material and a surface of road-mixed material 0.21 inch thick and 22

width of penetration-treated surface. Traffic used the existing railroad crossing during construction, and for a length of approximately 500 feet was routed over the new roadbed while under construction.

The greater part of the material composing the embankments was obtained from a borrow pit site adjacent to the work. Excavation was performed by two carryall units of 12 cubic yards capacity, powered by RD-8 tractors. The wet excavation in the channel and pier footings was removed by dragline and clamshell equipment.

The Wolf Creek channel was changed for a length of approximately 1000 feet, providing a channel with a 30-foot bottom width, 1 to 1 side slopes and a depth of 15 feet. The portion of the channel material suitable for roadway purposes was deposited in approach embankments while the remainder was used to heighten and reinforce the channel banks. Slope protection was provided where the channel was constructed on a curve of 300-foot radius, by placing sacked concrete on the face of the outer slope.

The highway overhead structure across the railroad consists of three 70-foot spans of 36-inch rolled I-beam girders, continuous in design. Expansion is provided for by hinges in each end span near the intermediate piers, and by rocker bearings at one intermediate pier. The intermediate piers each consist of 4 individual reinforced concrete columns on spread footings, while the end bents are supported on steel piles. The deck is a reinforced concrete slab approximately 7 3/4 inches in thickness, supported by 4 lines of girders. A 20-foot clear roadway is provided, with a 3-foot sidewalk on one side.

The Wolf Creek bridge is a 3-span structure quite similar in design to the overhead structure. All the bridge footings are supported on steel H-piles. The intermediate piers were founded below the level of the creek which necessitated the construction of cofferdams and the pouring of concrete seals to exclude water from excavations during the construction of the piers. The bridge piers are a single unit, rather than 4 individual columns as at the overhead. One end span is shortened to 52 feet while all other spans on both structures are 70 feet in length. The deck structure, hinge details, etc., are similar to those at the overhead.

The steel understructure of the deck is painted black while the railing is painted aluminum on both structures, providing a pleasing color contrast.

(Continued on page 21)

At top—Grade crossing on State Highway 83 near Greenville, Plumas County before improvement. Below—structures across railroad and stream connected by highway fill on improved alignment. Reinforced concrete overhead across railroad on two 4-column piers. Bottom—Highway bridge across Wolf Creek.



New Type Luminaire Developed for Entrance Points of Divided Highways

By F. M. CARTER, Assistant Maintenance Engineer

WITH the development of vapor lights conveying different reactions to the traffic on public ways, the traffic engineer and public officials have given much thought to an intelligent use of the various colored sources in an attempt to promote their uniform usage.

The yellow glow produced by sodium vapor lamps coincided so closely with the color used for many years on the public highways and over a much longer period of years in railroad operation, as a cautionary color, that it was immediately used by traffic engineers to give the same information on vehicular highways.

However, as utilized in actual practice, such illumination is not confined to locations requiring merely cautionary lights, though the sodium vapor light does provide this indication.

California, with the advent of the sodium vapor light, did use it for cautionary lighting at potentially hazardous accident recurring intersections of public ways—channelizations, intersections and at underpasses. A new problem is presented in providing a distinctive color for the entrance to divided highways.

The potential hazard at intersections is of a different character than that at the beginning of a divided highway, because in the latter case it is necessary to deflect the traffic at these points of separation into definite lanes of travel and to convey the necessary information that through the section of highway ahead traffic will be separated by a divisional area.

Assuming that these areas are for the most part rural in character, it was considered advantageous to confine this indication to the illumination of the curb at the point of the island and to the area the entering traffic might use. Traffic exiting

from such divisional sections should be readily and adequately advised without being forced to pass through an illuminated area which creates a period of darkness at a point where the potential hazard of head-on collision increases because of the lack of a divisional island.

TESTS TO DETERMINE TYPE

Through the cooperation of the General Electric Company, various types of luminaires were tested by the Division of Highways. The mercury vapor lamp was selected because its blue-white hue gave a distinctive color for this indication. The color sensitivity effect on the eye produced by mercury vapor reacts similarly with that produced by sodium vapor.

The new 250-watt Mercury vapor inner quartz envelope lamp has practically a point source of light. This makes it possible to shield the source of light from the eyes of traffic at the point of leaving the divisional island section of the highway without sacrificing advance warning indication and efficient distribution. It was found advantageous to use a mounting height that would confine the illumination to the point of the island and the area immediately adjacent to the entrance lanes.

LIMITATION OF OLD EQUIPMENT

A narrow angle floodlight, when mounted low, produced an effect which approached the desired objective. However, to obtain the best effect with a flood or spot light using the low mounting height, it was found that the glare thrown into the eyes of the exiting traffic was objectionable and very hard to overcome without louvers and shields which spoiled the lighting effect.

A highway type of luminaire with the lamp inclosed within a spun reflector globe combination was chosen

for the next test on night traffic.

These tests showed that the best results were obtained when the reflected source of light was:

(1) visible to the approaching entering traffic at a considerable distance.

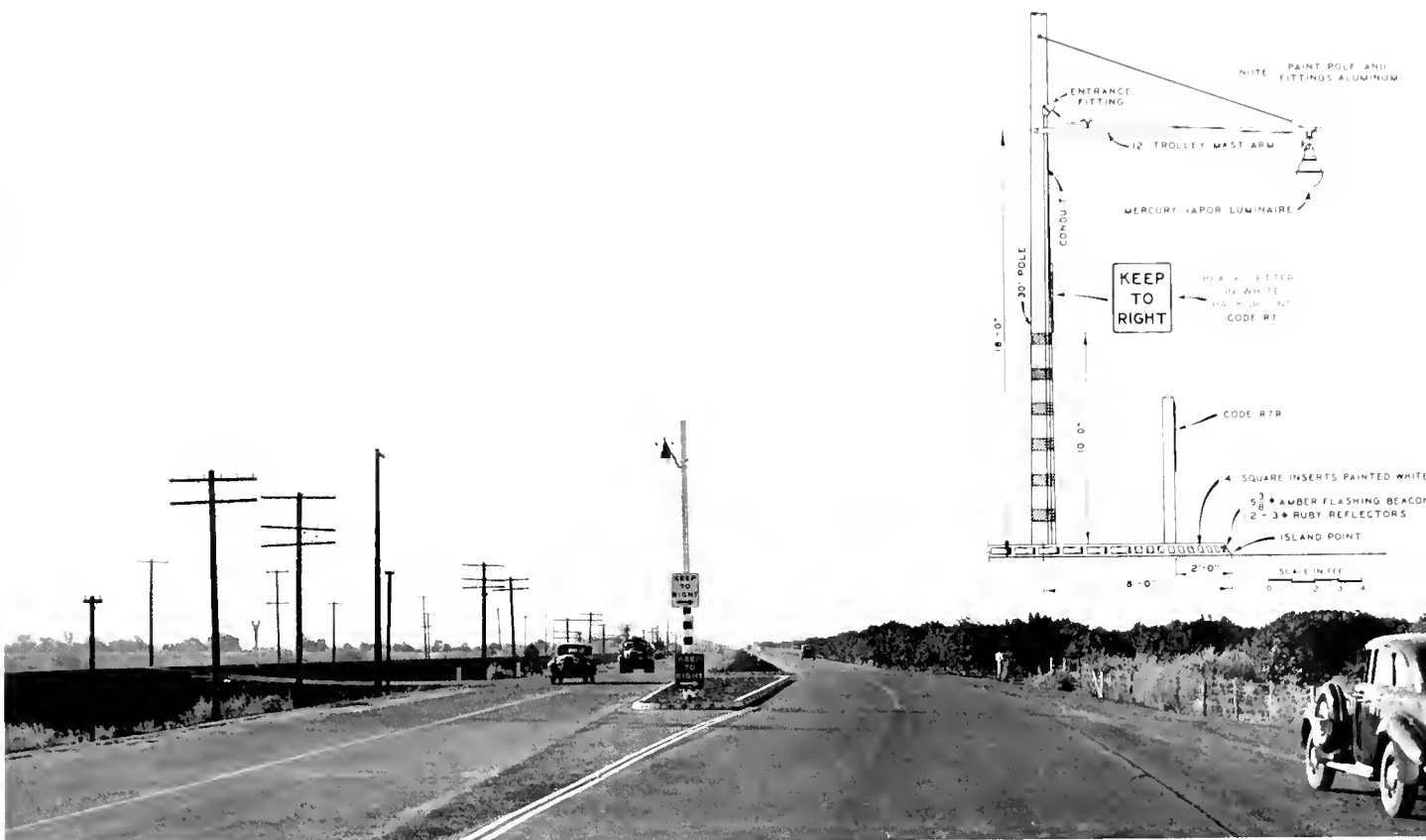
(2) visible from a distance to the exiting traffic but shielded from such traffic (to prevent "flashing the eyes") at the point of exit from divisional island section.

DESCRIPTION TEST APPARATUS

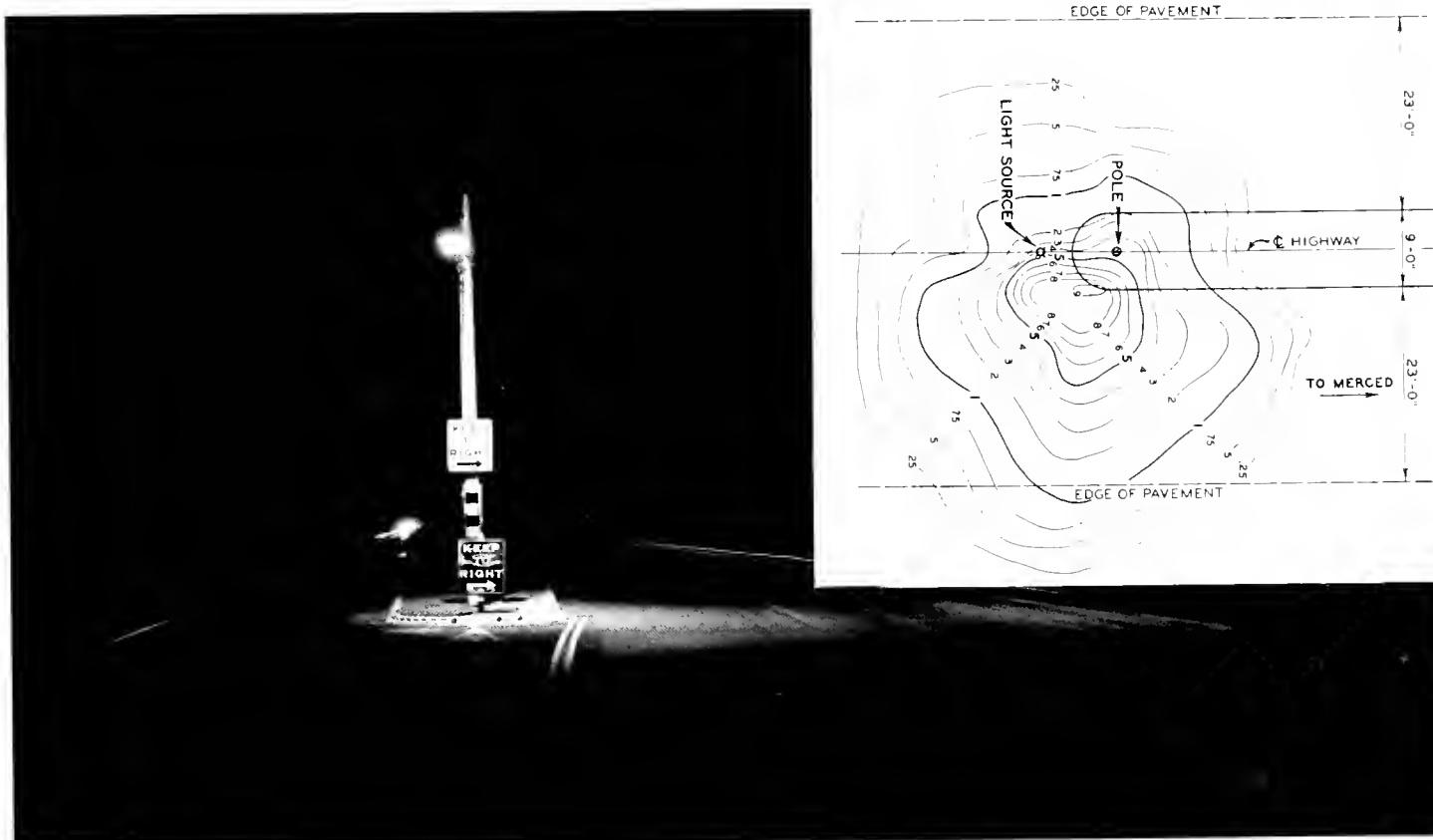
To obtain this effect, a G. E. type 79D luminaire was tested at an 18-foot mounting height (the minimum safe height considered practical) on a 12-foot trolley mast arm so that light distribution could be adjusted vertically and horizontally with respect to the point of island. An adjustable socket allowed the vertical distribution and the intensity of the maximum candle power, to be varied. The results of these tests with an explanation of the objectives above described were submitted to the laboratories and a special shaped shielding deflector was designed to produce the desired effect.

The final installation consists of an inclosed type distorted asymmetric distributing luminaire with adjustable socket mounting—a shielding deflector forming a right angle and fitting the shape of the spun-on globe, to keep the light out of the eyes of the approaching traffic and direct it transversely to the areas for which the illumination was desired. The reflector portion of the luminaire is stepped or fluted to direct the rays away from the opaque inner quartz stem of the lamp to obtain lower lamp operating temperatures and increased life. This advantage may be reduced to some extent by the new deflectors introduced within the luminaire, but

(Continued on page 25)



Daylight view of new divisional island lighting equipment on 30-foot pole with 12-foot arm 18 feet above ground.



Night view shows bright lighting of island point and signs. Inset graph of isolux lines shows illumination of approach lanes.



Improved appearance of U. S. 40 approach to M Street bridge, Sacramento, by tree and shrub plantings.
Inset shows former conditions.

Practical Roadside Development

The following article is the second and concluding instalment on practical highway landscaping by Mr. Bowers.

By H. DANA BOWERS, Landscape Engineer

CALIFORNIA'S varied topographical and climatic conditions make the problem of roadside landscaping rather unique. With the exception of harmonious location and grading, which is always appropriate, the various regions—coastal, valley, mountain and desert—should receive individual methods of landscape treatment.

The humidity of the coastal region allows for a more liberal interpretation of roadside improvement particularly in the use of plant materials. Seasonal rainfall is not always a controlling factor as regards the use of plants, as is exemplified by comparing

the valley and coastal regions. Although the rainfall may be comparable, the existence of atmospheric moisture completely changes growing conditions. Thus in the coastal region there lies the possibility of a comprehensive landscape treatment involving all of the basic landscape requirements as set forth by the Bureau of Public Roads. These are:

I. Landscape Grading (flattening, rounding transition slopes, etc.).

II. Obliteration of old roads, re-soiling borrow pits, etc.

III. Topsoiling, improving of existing soils and soil preparation necessary for seeding or planting.

IV. Planting of trees, shrubs as permitted by local soil, slope and climatic conditions.

V. Seeding or planting of grasses, succulents or other ground covers.

VI. Provision for properly designed rest areas or scenic turnouts.

Projects submitted for landscape credit must include these six basic stages of landscape work or the omission of any of them must be explained.

One of these requirements without at least a majority of the others will not qualify for Federal landscape participation.

Even casual study will reveal the

impracticability of formulating a definite set of rules to cover such a wide range of conditions as are encountered in California.

The coastal region, where such a standard may be conformed with, comprises only a small percentage of the State's area, while the majority of the State—valleys, mountains and desert—presents conditional problems that set a definite limitation on landscape treatment.

In order to carry on a practical and perpetual program of roadside improvement it appears only reasonable that this fact be recognized and a more flexible translation of comprehensive projects be made. Generally speaking, landscaping in the valley region is necessarily confined to tree planting and the flattening of roadside ditches. (Treatment at structures and possibly town entrances are excepted.) Tree planting must be programmed three to five years apart in order to keep within a reasonable and nonfluctuating maintenance set-up. Valley projects then must necessarily be few and far between.

The mountain regions offer opportunities that are perhaps of more esthetic and economic value than does the coastal. Although landscape features here are limited to grading, scenic turnouts, parking areas, topsoiling or general clean-up, *any one or all combined* definitely stand out as an improvement in roadside appearance.

To stipulate that all of these features shall be included in order to formulate a comprehensive plan is not always practical, since in many sections such as the semiarid foothills, clean-up of the right of way or the development of water and parking space might have a great esthetic value and render a useful public service.

In the higher altitudes more heavily covered with natural growth the intelligent use of topsoil on fills and flattened low cuts would bring about a rapid natural effect. Of course there are usually additional opportunities to provide other types of landscape treatment, but the point in mind is this—that even one basic landscape requirement is often highly desirable and worthy of application.

Landscaping in the desert is obviously limited to harmonious grading and top soiling—perhaps top sanding would be more nearly correct. There



Some comparable results of slope rounding are shown above.

is, in certain desert sections, opportunity to conserve or import the "seed coat," where natural desert flowers are known to be present, for a light covering over the slopes.

Cultivation of the area outside the shoulder will change growing conditions to the extent that the results will be surprising. The moisture retained under the pavement will give new life and appearance to desert roadside growth.

Contrary to popular belief, highway landscaping is not entirely a palliative or a follow-up embellishment of construction. Although the process nearly always involves in some way the use of plant material, it should be regarded and practiced less from the standpoint of artificial endeavor, and more from the practical and economical process of a natural restoration treatment to insure roadway permanence which automatically will improve roadside appearance.

There has been but little of this procedure in the past, due, as before mentioned, to inexperience. Mistakes have been made as is the case in any new line of endeavor that launches out on a large program too hurriedly. However, having profited by past experience we should now continue on a more practical basis.

Under way at present in San Luis Obispo County, between Pismo Beach and Arroyo Grande, is a day labor landscape project where the principles set forth in this article are being applied. The location was selected because of the opportunity to create an appreciable change in general roadside appearance by landscape



Scraper and bulldozer rounding and leveling top of cut slope.

grading and by reason of erosion and excessive weed growth, roadside maintenance could be reduced by the planting of self-establishing ground cover. In order to conform with Federal regulations governing landscape projects, groups of trees are also being planted.

Of particular interest is the method and cost of accomplishing slope rounding and transition operations on this project. The following is a description of the method used as written by Resident Engineer L. P. Davis, who has supervised all landscape projects in District V:

"A mechanical method of slope rounding has been developed in District V of the Division of Highways, in connection with certain roadside

development projects following construction which has proven very satisfactory, and is equally applicable to new construction.

"By this method, practically all of the tedious and expensive hand shaping has been eliminated and rounding is accomplished by the use of a scraper attached to a track-layer type tractor.

Requirements

"The requirements for satisfactory use of this method are that the top of slopes be of such a nature as to permit tractor operation, and that the soil be amenable to cutting and moving with the scraper.

Method

"Rounding is accomplished by backing the scraper over the top of the cut slope, lowering the cutting edge, and making a series of diagonal cuts across the edge of slope, the depth of which may be controlled by the operator.

"At the start of the operation, the cutting edge of the scraper lies in a plane with the slope. As the tractor progresses on a diagonal of approximately forty-five degrees to the edge of the slope, the upper wheel of the scraper reaches the summit, and the relative rate of elevation of the upper and lower sides of the scraper begins to change, resulting in a diagonal transition from the face of the cut to the top of slope.

"The equipment is again backed, slightly overlapping the previous cut and the operation repeated. After



Scarifier attachment behind scraper aids in working rocky formations.

(Continued on page 24)

Building Highway Tunnel by Open Cut in Presidio

The front cover picture shows one of the many unusual types of construction which the highway engineers build during these modern days. The picture shows a part of the approach road to the Golden Gate Bridge through the Presidio in San Francisco.

Inasmuch as this highway is being built through a United States military reservation, it is necessary to closely follow the restrictions and regulations imposed by the War Department, which provide that part of the route must be tunneled.

This tunnel portion carries the roadway beneath a section of the Presidio used as a parade ground for military maneuvers and a golf course, for which reason an open cut highway was not possible. Due to the sand formation and the small amount of material over the top of the tunnel, it was found more economical and practicable to use the so-called open cut and backfill method.

The highway is cut through as shown in the picture, permitting the tunnel to be built in 28-foot sections, and the pouring of the concrete in large quantities into the forms from above as illustrated in the photograph, with the aid of a crane and bottom-dump bucket.

The tunnel section is then backfilled or covered over with soil to restore the original ground surface and the false work removed from the interior.

The tunnel is 1300 feet in length and will accommodate a four-lane highway. The material taken from the tunnel cut was used to overload a section of fill on marshy ground skirting the edge of Mountain Lake. The material thus stockpiled as overload will later be used to backfill the tunnel and tunnel retaining walls.

The tunnel approaches the practical limit of length without requiring forced ventilation equipment, but ventilation is provided by a 24- by 24-foot shaft about midway of the length of the tunnel.

Speaking of public enemies, we know a plebe who whistles to wake the birds up every morning.

Thanks for Help

Millbrae, Calif.,
August 8, 1939.

California State
Highway Division,
Sacramento, California.

Gentlemen:

Your Mr. Holt, at the Burlington Station on the Redwood Highway, rendered us invaluable aid after an accident we suffered on the morning of July 8, 1939, near the Burlington Station. His courtesy and efficiency enabled us to proceed after minimum delay, and since he accepted no compensation for the assistance which he found in the line of duty, we wish to take this means of calling attention to his extraordinary helpfulness. If there is any recognition due to highway employees for unusual services, Mr. Holt is surely deserving of his share.

Thank you kindly for expressing to him our appreciation.

Yours truly,

E. E. PHILLIPS.

Grade Crossing Overhead Project

(Continued from page 15)

Ceremonies attending the formal opening of the project were held in conjunction with the annual "Gold Diggers Celebration" of the town of Greenville, and the colorful costumes of the visitors lent a festive appearance to the occasion. The ribbon cutting ceremony was climaxed by a parade led by a group of gaily dressed school children.

Representatives of the U. S. Bureau of Public Roads, the California Division of Highways, the Western Pacific Railroad, the Plumas County board of supervisors, the town of Greenville, and the contractor were present and addressed the group, expressing their satisfaction and gratification at the completion of this much needed improvement.

The contractor on the project was the George Pollock Co. of Sacramento, California.

Architecture Program Totals \$12,298,288

(Continued from page 5)

ments for State mental hospitals, prisons, reformatories, homes and schools for the blind, deaf and feeble-minded, armories and national guard encampments, colleges, agricultural exhibits and grandstands, office buildings, etc., the Division cares for all alterations and repairs to existing buildings.

We also design and install all heating, lighting, ventilating, refrigerating, water supply, mechanical and electrical plants as well as changes and extensions of original equipment; we survey grounds, lay out walks, drives and roads; provide water supply, sewer and drainage systems requiring the design and construction of dams, reservoirs, pipe lines, wells, pumping plants, ditches, sewage treatment and disposal plants and drains.

ALSO PROVIDE FURNISHINGS

Because of the legal interpretation of earlier appropriations we have been obliged to purchase and have delivered furnishings for buildings involving beds, mattresses, blankets, ticking, sheets, pillow slips, dishes, knives, forks, spoons, tables, chairs, ice cream freezers, etc.

It can readily be seen that our activities go far beyond the circumference of the meaning of the word "architecture."

It would appear that our work for the most part can be classified as having benevolent tendencies and accordingly should be entered on the credit side of Gabriel's ledger. On the other hand, however, we wonder how the powers that be will measure our credits against the construction of a lethal gas chamber at the San Quentin Prison which was designed and constructed for the sole purpose of taking human lives.

Bill—"Have you ever seen one of those inventions that tell when a man is lying?"

Jack—"Seen one? I married one."—*Portland Oregonian*.

Mrs. Newdriver (to garage mechanic)—"They tell me I have a short circuit. Can you lengthen it while I wait?"—*Christian Science Monitor*.

Pinole Grade Separation on U. S. 40 Carries Highway Over Railroad

THE Pinole Overhead, separating the grades of Highway U. S. 40 and the Atchison, Topeka and Santa Fe Railroad, was completed on September 1. This improvement, located on the main transcontinental trunk highway 16 miles east of Oakland, is another unit in the intensive railroad grade separation program started in 1936.

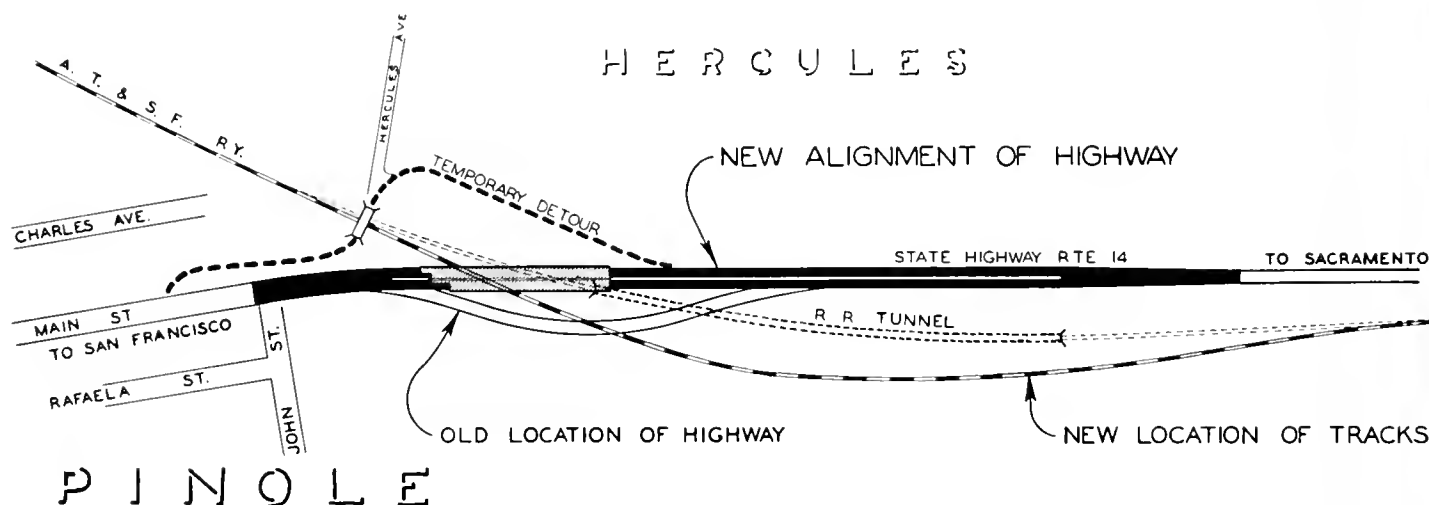
Previous to construction of the new structure, the old highway was located over the Santa Fe Tunnel near its portal. The old highway, consisting of a 30-foot paved surface, was on poor alignment with short radii reverse curves and a portion of

foot 6-inch end spans. The structure is of rigid frame design, which permits the use of lighter sections and aids in obtaining the necessary vertical clearances over the railroad grades. The conservation of head room is very important at this location, as the south end of this project is located in the town of Pinole where it is necessary to maintain the existing street grade. The new road crosses the railroad track at an elevation six feet lower than that of the old road.

The spans of the bridge are supported by three columns and the span lengths are apportioned in such a

of the acute angle of intersection between the center line of the railroad and the highway, as well as the necessity of maintaining railroad traffic at all times during construction. The project involved the relocation of the Santa Fe tracks in an open cut and the abandonment of the former railroad tunnel. This required the relocation of approximately 3500 feet of track and the removal of 400,000 cubic yards of excavation.

In constructing the overhead structure it was necessary to coordinate the work with that of the Santa Fe in order that construction delays would



it was located in a cut, with sight distance restricted.

The new alignment eliminates 67 degrees of curvature and is a link in the general improvement of the State highway routing from Sacramento to the Bay area, which includes the recently completed line change south of Vacaville, the revised location from Fairfield to Cordelia and the American Canyon cut-off.

The structure over the tracks is built of reinforced concrete. It is 425 feet long and has two 25-foot roadways separated by a four-foot dividing strip which separates traffic from opposite directions. There are eleven 34-foot slab spans and two 25-

manner that the railroad can pass under the structure between the columns at an angle of intersection with the highway of 26 degrees 12 minutes. This arrangement allows the construction of the supports at right angles to the center line of roadway and thus obviates the necessity of designing the structure on a skew.

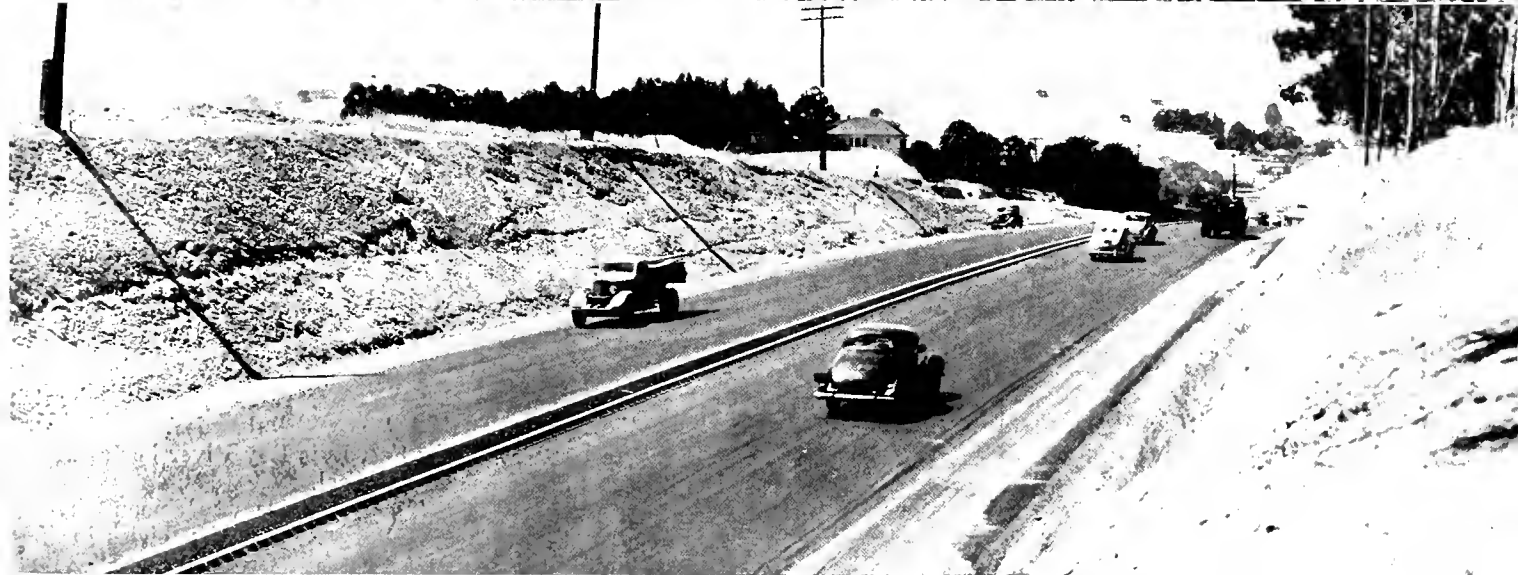
Collision walls extending seven feet above the ground were constructed between the columns paralleling the track, to protect the structure against the possibility of projecting loads from trains.

The design as well as the construction was made difficult because

be reduced to a minimum. During the time that train traffic was using the old tunnel and track the south half of the structure was completed, the railroad cut was made, the new tracks laid and train traffic was transferred to the new railroad location. The old tracks were then removed and construction of the north half of the structure proceeded without interference.

All work in connection with the construction of the overhead and approaches was handled by the State Division of Highways. The work of making the railroad cut and other work incidental to realigning the

(Continued on page 24)



Views of new grade separation on U. S. 40 near Pinole in Contra Costa County where the highway formerly crossed over the railroad tunnel. At top—New divided highway bridge over railroad. Center—New railroad cut. Bottom—Divided highway approach.

Practical Roadside Development

(Continued from page 20)

the first slice has been made, the upper scraper wheel is rolling on the above mentioned transition, causing a smooth transverse rotation of the scraper's cutting edge as the equipment progresses, resulting in improved control.

"For further rounding a new series of cuts are made at approximately right angles to the first. This second operation increases the radius of rounding and results in a curve of improved smoothness due to the fact that both wheels of the scraper are this time rolling on the transition. These series of cuts may be continued, limited only by the ability of tractor to operate on the rounded slope. Scraping may be supplemented by the use of a scarifier.

"Should it be desirable to greatly increase the radius of rounding beyond the normal limits of safety for tractor operation, this may be accomplished by increasing the length of "hitch" or distance between tractor drawbar and the cutting edge of scraper.

"In addition to the rounding described above, this method is used at the ends of cuts to develop transitions from existing slopes to normal ground.

Advantages

"Slope rounding by hand methods, or by bulldozer, results in all trimmed material falling to the gutter where it must be rehandled and disposed of by trucks.

"With the method heretofore described, there is a minimum of slough to be handled due to the fact that practically all material removed in the rounding operation is drawn to the top of cut where it may be drifted into surface irregularities by the same equipment, greatly improving the profile line of cut.

Costs

"On the Federal aid landscaping project between Pismo Beach and Arroyo Grande, 9725 lineal feet of slopes, ranging from a light sand to compacted gravel, adobe soil and sandstone, were rounded and transitions developed at the ends of cuts by the above method for an expenditure on tractor and equipment of

\$798.72, or a cost of approximately \$0.082 per lineal foot. This rounding was somewhat more extensive and involved a greater yardage than is ordinarily encountered on construction work, since many of the cuts were graded appreciably lower.

"On a number of cuts, due to existing right of way fences, excessive erosion and rocky ledges, it was impractical to operate the tractor and equipment. In these places hand methods of rounding were employed at a total cost of \$450. This included the removal of slough on hand operations, also minor clean-up of slopes on the entire project, and left the slopes in a finished condition preparatory for ground cover planting operations. The cost of this supplemental hand rounding was approximately \$0.046 per lineal foot for the job providing a combined cost as follows:

Mechanical method of slope rounding 9725 l. f.-----	\$798.72
Supplemental hand slope rounding -----	450.00
	<hr/> \$1,248.72

"Making a total cost for the complete rounding and grading of approximately \$0.128 per lineal foot."

Pinole Grade Separation on U. S. 40

(Continued from page 22)

tracks was handled and financed by the Santa Fe Railroad. The railroad company also assumed the obligation of furnishing the necessary additional right of way for both the railroad and the highway. The cost to the railroad for its portion of the project amounted to approximately \$125,000; while the cost to the State was approximately \$110,000.

Work was started on the project on September 12, 1938. Rail traffic was transferred to the new location on April 24, 1939, and the bridge was opened to traffic on August 4, 1939. The work was performed under contract by the Union Paving Company. John E. Burke was Resident Engineer in charge of construction for the State.

Palomar Highway to the Stars

(Continued from page 10)

recently completed or under way which are used as approach roads are:

(1) 3.3 miles Iron Spring Creek to the observatory site, built by State contract.

(2) About 9 miles from State Route 195 to Iron Springs Creek by county forces.

(3) About 2.8 miles reconstruction on Cu Cu Grade State Route 195 completed by State contract in 1937.

(4) Reconstruction of the Rincon Grade, bridges and oiling of the surface on the Valley Center County Road, Escondido to Rincon, by county forces.

(5) State prison camp work, about eight miles of reconstruction along the San Luis Rey River between La Jolla Indian Reservation and Morettis, still in progress near Lake Henshaw.

(6) A State supervised project constructing a reinforced concrete bridge across the San Luis Rey River at Rincon, now completed.

(7) Two Federal Government reconstruction projects recently completed by the Public Roads Administration within Pala and La Jolla Indian Reservations, 3.2 miles and 2.2 miles long respectively.

All large and heavy loads have now been moved with the exception of the mirror and two large gears being completed at Pasadena.

From now on the "Highway to the Stars" and its feeder roads will be called on to carry an increasing passenger car traffic. The observatory will draw scientists from all over the world, together with many tourists and others having only a casual interest in astronomy. A visitors' gallery is provided from which the huge telescope can be seen without disturbing the work of the astronomers. A museum of astronomical photographs will also be open to the general public.

The trip over the approach roads and the road up the mountain is very attractive. A portion of the "Highway to the Stars" passes through densely timbered country of great beauty and the approach through the Indian reservations, past the San Luis Rey and Pala missions and along the San Luis Rey River has considerable appeal.

Traffic counts at Rincon show a 24-hour total of 172 vehicles in 1934 and 895 vehicles in 1939. The increase will probably continue after the observatory is completed.



Grade separation at Famosa in Kern County on Golden State Highway (U.S. 99) carrying 2 railroad tracks over a 4-lane highway.

New Type Luminaire Developed for Division Islands

(Continued from page 16)

test results on this point are not yet available.

The lamp is a 250-watt mercury vapor, 10,000 lumens, type H5A, which at present has the same service life as incandescent Mazda lamps, but which, no doubt, will be improved as was the case with the Sodium Vapor, to approximate that of Sodium lamp life. The unit was mounted 18 feet above the pavement on a 12-foot trolley mast arm fixed to a pole set eight feet back from the point of the island. The luminaire hangs four feet out from the point of the divisional island on the center line extended.

FOOT CANDLE GRAPH

The accompanying graph of the isolux lines for horizontal foot candles shows how the illumination from this specially designed deflector meets the requirements as submitted. The far lane of the exiting traffic receives practically no illumination, and the inner lane receives but three-quarters of a foot candle. A distant indication is received by this traffic with no flash at the point of exit. The point of the island on the exit side receives two-foot candles and this illumination on the curb at the point increases to four-foot candles at the center, with nine-foot

candles on the curb and immediate adjacent pavement at the entrance. The area receiving eight-foot candles is correctly located to provide the indication where needed most.

The direction and spread of light as shown by this graph of final illumination is obtained with no flash or source of light being visible to the entering or exiting traffic. A sign, 30 by 36 inches with black copy on a white background, reading KEEP TO RIGHT, is placed on the light standard at a height of approximately ten feet from the bottom of the sign above the pavement. This height was determined by readings in order to place the sign in the maximum beam from the luminaire. The legibility of this sign produced by the blue-white mercury vapor light was increased nearly 100 per cent over daylight visibility. The sign, while not legible, was visible to approaching drivers from a considerably greater distance.

In order to provide extra safety a flashing yellow beacon was imbedded in the curb at the point of the island with a three-inch reflector on either side. A low mounted reflectorized KEEP TO RIGHT sign also gives an additional factor of safety.

California is the first state to make

use of this distinctive lighting of approach island points and channelization area.

Since the installations are comparatively recent there has been no opportunity to evaluate the effect on accident reduction. However, the favorable reaction from several traffic engineers as well as the motoring public indicates that this new idea of a definite and distinctive area illumination will be a contribution to safety.

Mexico Dedicates Link of International Highway

Mexico officially opened a modern paved stretch of more than 400 miles of the International Pacific Highway between Guadalajara and Mexico City on Saturday, July 29.

Dedication ceremonies marked surfacing of the entire link and another step in the development of the west coast tourist route now traversable from Southern California via Nogales, Arizona, to the capital of Mexico.

The Federal highway borders the beautiful Lake Chapala, largest in the Republic and passes also extensive Lake Patzenaro.

Highway Bids and Awards for the Month of August, 1939

BUTTE COUNTY—Between Mile 8.90 and Mile 10.50, and between Mile 11.00 and Mile 14.30, about three and four-tenths miles in length, road mix surfacing to be constructed. District III, Route 87, Sections A and B. Lee J. Immel, Berkeley, \$14,141; Fredericksen & Westbrook, Sacramento, \$16,701; Garcia Const. Co., Irvington, \$14,068; Hemstreet & Bell, Marysville, \$12,882; Harms Bros., Sacramento, \$14,636; Spaletta, Siri & Siri, Santa Rosa, \$13,291; E. P. Bishop, Orland, \$17,000. Contract awarded to Embleton & Schumacher Co., Albany, for \$11,970.15.

BUTTE COUNTY—Between Railroad Crossing and Route 21, about 2.4 miles to be surfaced with plant-mixed surfacing. District III, Route 87, Section A. Hemstreet & Bell, Marysville, \$11,402; Fredericksen & Westbrook, Sacramento, \$10,945. Contract awarded to Piazza and Huntley, San Jose, \$8,625.

CALAVERAS AND ALPINE COUNTIES—Between Dorrington and Markleeville, about 23.7 miles road-mix surface treatment to be applied. District X, Routes 23 and 24, various sections. Lee J. Immel, Berkeley, \$25,111. Contract awarded to Oranges Bros. Construction Department, Stockton, \$20,664.50.

COLUSA, BUTTE, SACRAMENTO, YOLO AND PLACER COUNTIES—At various locations in District III, about 31.4 miles seal coat to be applied. C. F. Fredericksen & Sons, Lower Lake, \$19,609; E. F. Hilliard, Sacramento, \$21,193; J. C. Compton, McMinnville, Ore., \$19,155; Granite Construction Co., Ltd., Watsonville, \$18,933; Lee J. Immel, Berkeley, \$18,535. Contract awarded to E. A. Forde, San Anselmo, \$17,888.45.

EL DORADO COUNTY—Between 2 miles east of Phillips and 3 miles west of Meyers, about 2.4 miles imported surfacing material to be placed and road-mix surface treatment applied. District III, Route 11, Section I. J. A. A. Tieslau, Berkeley, \$14,886; Louis Biasotti & Son, Stockton, \$15,433; Fredericksen & Westbrook, Sacramento, \$16,153; Pacific Truck Service, Inc., San Jose, \$16,904. Contract awarded to Lee J. Immel, Berkeley, \$12,617.30.

FRESNO AND KINGS COUNTY—Near Lemore, about 31.3 miles road-mix surface treatment to be applied. District VI, Routes 10 and 125, Sections F, B, C, D. A. S. Vinnell Co., Alhambra, \$11,450; Oranges Bros., Construction Dept., Stockton, \$11,551; Stewart & Nuss, Inc., Fresno, \$11,636; L. A. Briscoe, Arroyo Grande, \$12,103; Piazza and Huntley, San Jose, \$13,430. Contract awarded to Basich Bros., Torrance, \$9,925.40.

FRESNO COUNTY—Between Kingsburg and Fresno, about 11.8 miles in length to be surfaced with plant-mixed surfacing and nonskid surface treatment applied. Dist. VI, Route I, Sections A, Fow, R. Union Paving Co., San Francisco, \$16,564; Granite Const. Co., Ltd., Watsonville, \$16,238. Contract awarded to Leo A. Briscoe, Arroyo Grande, \$15,816.15.

FRESNO COUNTY—Across Big Dry Creek near Humphreys and near Tollhouse, two bridges to be widened. District VI, Route 76, Section B. Thomas Construction Co., Ontario, \$8,943; L. C. Seidel, Oakland, \$9,238; Jourdan Concrete Pipe Co., Fresno, \$10,083; Nelson & Wallace, Escalon, \$10,295; C. C. Gildersleeve, Berkeley, \$10,558; R. Hodgson & Sons, Porterville, \$11,078;

A. Soda & Son, Oakland, \$13,095; A. S. Vinnell Co., Alhambra, \$16,375. Contract awarded to Midstate Construction Co., Fresno, \$8,621.50.

HUMBOLDT COUNTY—About 3 miles south of Scotia, bridge across Eel River to be repaired. District I, Route I, Section E. Ernest E. Smith, Eureka, \$13,839; Fred J. Maurer & Son, Eureka, \$15,473; C. C. Gildersleeve, Berkeley, \$14,486. Contract awarded to Reginald G. Clifford, San Francisco, \$12,943.65.

KERN COUNTY—Between Arvin and 2.5 miles east of Monolith, about 16.2 miles road-mix surface treatment to be applied. District VI, Routes 58, 140, Sections EFG, D. Basich Bros., Torrance, \$7,380; J. E. Haddock, Ltd., Pasadena, \$7,828. Contract awarded to A. S. Vinnell Co., Alhambra, \$6,897.50.

KERN AND INYO COUNTIES—Between Johannesburg and Olancha, about 28.5 miles seal coat to be applied. District IX, Routes 145 and 23, Sections A, B, C, I. Basich Bros., Torrance, \$14,854; J. A. Casson, Hayward, \$15,562; W. R. Shriver, Los Angeles, \$17,684; V. R. Dennis Construction Co., San Diego, \$18,660; J. E. Haddock, Ltd., Pasadena, \$19,884. Contract awarded to A. S. Vinnell Co., Alhambra, \$14,285.20.

KERN AND KINGS COUNTIES—Between Blackwells Corner and Route 125, about 22.6 miles road-mix surface treatment to be applied. District VI, Route 138, Sections E, A. Granite Construction Co., Ltd., Watsonville, \$9,484; Basich Bros., Torrance, \$10,155; A. S. Vinnell Co., Alhambra, \$10,162; L. A. Briscoe, Arroyo Grande, \$11,784; John Jurkovich, Fresno, \$12,518; Stewart & Nuss, Inc., Fresno, \$13,072; Oilfields Trucking Co., Bakersfield, \$19,186. Contract awarded to Clyde W. Wood, Los Angeles, \$7,298.49.

KERN COUNTY—Portions between Bakersfield and Weldon, about 41.6 miles road-mix surface treatment and seal coat. District VI, Routes 57 and 142, Sections A, B, E, F, G, I. Oilfields Trucking Co., Bakersfield, \$19,488; Maceo Construction Co., Clearwater, \$24,266; Basich Brothers, Torrance, \$17,678; A. S. Vinnell Co., Alhambra, \$22,527; Griffith Co., Los Angeles, \$25,482. Contract awarded to Clyde W. Wood, Los Angeles, \$14,484.35.

KERN COUNTY—Between Lerdo and Delano, about 19.1 miles nonskid surface treatment to be applied. District VI, Route 4, Sections D, E, F. Granite Construction Co., Ltd., Watsonville, \$15,742; J. A. Casson, Hayward, \$16,382; Piazza & Huntley, San Jose, \$17,410; Stewart & Nuss, Inc., Fresno, \$18,885. Contract awarded to A. S. Vinnell Co., Alhambra, \$14,895.

KERN COUNTY—Between Taft and Western Water Works, about 12 miles road-mix surface treatment to be applied. District VI, Route 140, Section A. Basich Bros., Torrance, \$5,149; L. A. Briscoe, Arroyo Grande, \$5,744; J. E. Haddock, Ltd., Pasadena, \$7,185; Oilfields Trucking Co., Bakersfield, \$8,603. Contract awarded to A. S. Vinnell Co., Alhambra, \$1,968.16.

KINGS AND FRESNO COUNTIES—Between Route 10 and 6 miles south of Fresno, about 23.0 miles in length nonskid surface treatment to be applied. District VI, Route 125, Sections E, A, B. Granite Construction Company, Ltd., Watsonville, \$14,920; A. S. Vinnell Co., Alhambra, \$16,445; Lee J. Immel, Berkeley, \$16,538; Stewart & Nuss,

Inc., Fresno, \$16,631. Contract awarded to L. A. Briscoe, Arroyo Grande, \$14,810.

KINGS COUNTY—Near Dallas School, about 1.5 miles to be surfaced with plant-mixed surfacing. District VI, Route 135, Sections A, B. Piazza and Huntley, San Jose, \$6,062; L. A. Briscoe, Arroyo Grande, \$6,515. Contract awarded to Union Paving Co., San Francisco, \$5,870.

LASSEN AND MODOC COUNTIES—Between Summit of Big Valley Mt. and Adin, about 2.1 miles road-mix surfacing and seal coat to be placed. District II, Route 28, Section AA. A. A. Tieslau, Berkeley, \$7,387.80. Contract awarded to Powers & Patterson, Greenville, \$5,491.50.

LASSEN COUNTY—Repairing by removing the existing superstructures and replacing with reinforced concrete six bridges over the Pit River and Overflows, south of Bieber, consisting of 39 thirty-foot spans. District II, Route 28, Section A. J. P. Brennan, Redding, \$62,706; C. W. Caletti & Co., San Rafael, \$63,787; Underground Construction Co., Oakland, \$65,948; D. W. Nicholson, Oakland, \$66,204; E. T. Lesure, Oakland, \$67,285; Clifford A. Dunn, Klamath Falls, Ore., \$68,687; R. H. Travers, Los Angeles, \$72,293; L. D. Tonn, Lodi, \$71,751; J. S. Metzger & Son, Los Angeles, \$74,389; R. G. Clifford, San Francisco, \$78,968. Contract awarded to Poulos & McEwen & M. A. Jenkins, Sacramento, \$62,118.

LASSEN COUNTY—Between Termo and northerly boundary, about 1.3 miles to be graded, surfaced with crusher run base and road-mix surfacing and about 7 miles to be surfaced with roadmix surfacing. District II, Route 75, Sections F, G. Harms Bros., Sacramento, \$47,931. Contract awarded to Poulos & McEwen, Sacramento, \$37,924.20.

LOS ANGELES COUNTY—Between San Gabriel River Bridge and 23.6 mile northerly, about 14.9 miles road-mix surface treatment to be applied. District VIII, Route 62, Sections A, B. Clyde W. Wood, Los Angeles, \$14,518; Oilfields Trucking Co., Bakersfield, \$14,532; J. E. Haddock, Ltd., Pasadena, \$17,063; R. M. Price, Huntington Park, \$18,445. Contract awarded to Basich Bros., Torrance, \$13,458.

LOS ANGELES COUNTY—At Pacific Colony State Hospital, near Spadra, roadways, to be surfaced with plant-mix surfacing on imported subgrade material and Portland cement concrete curbs and sidewalks to be constructed. Dist. VII, Route Pacific Colony, Geo. J. Bock Co., Los Angeles, \$26,459; Edward Green, Los Angeles, \$27,139; J. E. Haddock, Ltd., Pasadena, \$33,846; W. E. Hall Co., Alhambra, \$37,715. Contract awarded to Griffith Co., Los Angeles, \$25,913.50.

LOS ANGELES COUNTY—Between La Canada and Mt. Wilson, about 12.8 miles road-mix surface treatment to be applied. District VII, Route 61, Section A. Pas. R. E. Hazard & Sons, San Diego, \$16,332; Warren Southwest, Inc., Los Angeles, \$17,388; J. E. Haddock, Ltd., Pasadena, \$21,253. Contract awarded to R. M. Price, Huntington Park, \$13,201.50.

MADERA COUNTY—Between San Joaquin River and Kelshaw Corners, about 18.9 miles in length, about 10.9 miles to be surfaced with imported borrow and road-mix surface treatment applied thereto, and about 8.0 miles road-mix surface treatment to be applied to the existing roadbed. District VI, Route 125, Sections A, B, C. L. A. Briscoe, Arroyo Grande, \$59,217; Union

Paving Co., San Francisco, \$53,571; J. C. Compton, McMinnville, Ore., \$59,951; Basich Bros., Torrance, \$60,836; C. F. Fredericksen & Son, Lower Lake, \$52,814; Louis Biasotti & Son and Claude C. Wood, Stockton, \$58,065; Stewart & Nuss, Fresno, \$47,547; Oilfields Trucking Co., Bakersfield, \$47,366; Lee J. Immel, Berkeley, \$55,489; Griffith Company, Los Angeles, \$54,757. Contract awarded to Ruddy and Corfield, Modesto, \$44,224.65.

MENDOCINO COUNTY—At Shearing Creek about 6 miles southeast of Boonville, a reinforced concrete slab bridge to be constructed and about 0.5 mile of roadway to be graded, blanketed with imported borrow and prime coat and seal coat applied. District I, Route 48, Section A. E. E. Smith, Eureka, \$19,691; L. C. Seidel, Oakland, \$21,857; Guerin Bros., San Francisco, \$20,585; A. H. Siemer & John Carcano, San Anselmo, \$20,262; Anderson & France, Visalia, \$17,164; Embleton-Schumacher, Albany, \$17,354. Contract awarded to M. A. Jenkins, Sacramento, \$17,148.95.

MENDOCINO COUNTY—At Getchell, Quindiven, Irish and Laurel Gulches, about 1.2 miles to be graded, blanketed with imported borrow, and prime coat and seal applied thereto. District I, Route 56, Sections A. B. C. John Burnan & Sons, Eureka, \$64,453; C. W. Caletti & Co., San Rafael, \$44,487; H. Earl Parker, Marysville, \$63,817; Chas. L. Harney, San Francisco, \$67,319; Claude C. Wood, Lodi, \$89,086; Harold Smith, St. Helena, \$72,399; George Pollock Co., Sacramento, \$68,726; Guerin Bros., San Francisco, \$69,847; Fred J. Maurer & Son, Eureka, \$74,915; Caputo & Keeble, San Jose, \$87,136. Contract awarded to J. L. Connor & Sons, Ukiah, \$55,542.90.

MONO COUNTY—Between Mono Lake and Benton, 20.8 miles in length, penetration oil treatment to be applied. Dist. IX, Route 40, Sections C,D,E,F. A. S. Vinnell Co., Alhambra, \$8,730; Oilfields Trucking Co., Bakersfield, \$11,002. Contract awarded to Basich Bros., Torrance, \$7,362.

MONO COUNTY—Between Bridgeport and the State line, about 13.4 miles to be graded and penetration oil treatment applied. District IX, Route 96, Section A. Fredericksen & Westbrook, Sacramento, \$23,841; Isbell Construction Co., Reno, \$24,350; J. E. Anderson & George E. France, Visalia, \$25,410; A. S. Vinnell Co., Alhambra, \$23,130. Contract awarded to Basich Brothers, Torrance, \$22,615.

MONO COUNTY—Between Yosemite National Park and Lake Ellery, about 2.5 miles to be graded, surfaced with imported surfacing material and road-mix surface treatment applied, and a multiple C. M. P. culvert to be furnished and installed. District IX, Route 40, Section A. Fredericksen and Westbrook, Sacramento, \$90,000; A. S. Vinnell Co., Alhambra, \$94,881. Contract awarded to Isbell Construction Co., Reno, Nev., \$70,746.50.

MONTEREY AND SAN LUIS OBISPO COUNTIES—Between San Simeon and Big Sur, about 27 miles road-mix surface treatment and seal coat to be applied. District V, Route 56, Sections A, B, C, D, E. Oilfields Trucking Co., Bakersfield, \$23,955; Lee J. Immel, Berkeley, \$23,982; Clyde W. Wood, Los Angeles, \$24,262; Ruddy and Corfield, Modesto, \$26,050; Basich Bros., Torrance, \$26,240; J. E. Haddock, Ltd., Pasadena, \$34,068. Contract awarded to L. C. Karstedt, Watsonville, \$19,906.35.

NEVADA, PLACER, EL DORADO—At various locations in District III, about 46 miles seal coat to be applied. A. Teichert & Son, Inc., Sacramento, \$25,063; J. C. Compton, McMinnville, Ore., \$25,953; Lee J. Immel, Berkeley, \$26,220; C. F. Fredericksen & Sons, Lower Lake, \$27,597; A. A. Tieslau, Berkeley, \$28,264. Contract awarded to

Builders of Good Will

Los Angeles, Calif.

Mr. C. H. Purcell,
State Highway Engineer,
Sacramento, California.

Dear Sir:

Under date of July 20 we received the following letter from the Western Novelty Company, by Charles H. Cohn:

"I want to take this time to express my appreciation for the courtesy shown me by one of your road marking crew of the men on Highway 101 in Malibu. Especially, Mr. C. C. Nelson. With crews of this kind on the State Highways, it will go a long way to build up good will with the traveling public.

"The writer had motor trouble just north of Malibu and this crew, while on lunch hour, took it upon themselves to be helpful. Friendly gestures of this kind will go a long way to build up a mutual feeling of respect, both for the workmen and the motorist."

Yours very truly,

S. V. CORTELYOU,
District Engineer.

Granite Construction Co., Ltd., Watsonville, \$24,636.85.

ORANGE, LOS ANGELES COUNTIES—At various locations, about twelve miles in length, road-mix surface treatment to be applied. Dist. VII, Routes 43, 175 and 176, Sections A,B and C. R. M. Price, Huntington Park, \$11,610; R. E. Hazard & Sons, San Diego, \$12,577; A. S. Vinnell Co., Alhambra, \$13,121; C. R. Butterfield-Kennedy Co., San Pedro, \$14,167; Dimmit & Taylor, Los Angeles, \$14,605. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$10,444.

ORANGE COUNTY—Near Galivan, about four-tenths mile in length to be graded and surfaced with plant-mixed surfacing. Dist. VII, Route 2, Section A,B. V. R. Dennis Const. Co., San Diego, \$12,456; A. S. Vinnell Co., Alhambra, \$13,106; Basich Bros., Torrance, \$13,477; J. E. Haddock, Ltd., Pasadena, \$13,765; Martin & Schmidt Contractors, Long Beach, \$14,000; R. L. Oakley, Pasadena, \$15,650; C. R. Butterfield-Kennedy Co., San Pedro, \$16,984. Contract awarded to B. G. Carroll, San Diego, \$12,233.50.

PLACER COUNTY—Between Colfax Overhead and 0.6 mile north, about 0.6 mile to be graded and surfaced with plant-mixed surfacing. District III, Route 37, Section Cfx. C. Parish Bros., Los Angeles, \$72,260; Piazza & Huntley, San Jose, \$31,970; Poulos & McEwen, Sacramento, \$33,055; Fredericksen & Westbrook, Sacramento, \$34,008; Louis Biasotti & Son, Stockton, \$34,465. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$30,851.75.

PLUMAS COUNTY—Between 14.1 miles east of Howells and Beckworth, about 12 miles seal coat to be applied. District II, Route 21, Sections B, C, D, E, F. Close Building Supply, Hayward, \$9,127; C. F. Fredericksen & Sons, Lower Lake, \$9,640. Contract awarded to Hayward Building Material Co., Hayward, \$8,877.50.

PLUMAS COUNTY—Between 2 miles west of Route 83 and Chester, about 5.1 miles to be surfaced with road-mix surfacing and seal coat. District II, Route 29, Section A. A. A. Tieslau, Berkeley, \$11,107; Henley-Moore Co., Fredericksen & Watson Construction Co., Oakland, \$11,115; C. F. Fredericksen & Sons, Lower Lake, \$11,822; Powers & Patterson, Greenville, \$11,991; Lee J. Immel, Berkeley, \$12,056; E. B. Bishop, Orland, \$13,579. Contract awarded to Garcia Construction Co., Irvington, \$11,356.50.

RIVERSIDE AND SAN BERNARDINO COUNTIES—At various locations in District VIII, about 81.7 miles road-mix surface treatment and seal coat to be applied. R. E. Hazard & Sons, San Diego, \$64,922; Basich Bros., Torrance, \$69,753; J. E. Haddock, Ltd., Pasadena, \$67,133. Contract awarded to Geo. Herz & Co., San Bernardino, \$64,753.60.

SAN BENITO COUNTY—Between Lompoc Road and Bear Valley, between Pinnacles and Route 119, and between Pajaro River and 0.5 mile southerly, about 28 miles to be treated with liquid asphalt. District V, Routes 119 and 120, Sections B, C, F, A. L. A. Briscoe, Arroyo Grande, \$6,609; Granite Construction Co., Ltd., Watsonville, \$7,224. Contract awarded to Oilfields Trucking Co., Bakersfield, \$4,495.

SAN BERNARDINO COUNTY—Across Santa Ana River one mile south of Colton, a reinforced concrete bridge with steel stringers to be constructed. District VIII, Route 43, Section F. George Herz & Co., San Bernardino, \$64,157; J. S. Metzger & Son, Los Angeles, \$65,210; V. R. Dennis Construction Co., San Diego, \$66,373; Gibbons & Reed Co., Burbank, \$69,711; Ryerts & Dunn, Los Angeles, \$69,782; Carlo Bongiovanni, Los Angeles, \$71,016; Vinson & Pringle, Phoenix, Ariz., \$73,259; Matich Bros., Elsinore, \$78,785. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$63,471.15.

SAN BERNARDINO COUNTY—Between Big Bear Dam and Meadow Lane, about 7.2 miles in length, road-mix surfacing and seal coat to be applied. Dist. VIII, Route 43, Sections C and G. Clyde Wood, Los Angeles, \$24,829; R. M. Price, Huntington Park, \$27,799; Ruddy & Corfield, Modesto, \$30,885; A. S. Vinnell Co., Alhambra, \$31,304; J. E. Haddock, Ltd., Pasadena, \$41,148; E. L. Yeager, Riverside, \$44,844; Geo. Herz & Co., San Bernardino, \$47,442. Contract awarded to R. E. Hazard & Sons, San Diego, \$23,554.50.

SAN LUIS OBISPO COUNTY—Between Cambria and 3 miles south of Paso Robles, about 21 miles penetration oil treatment and seal coat to be applied. District V, Route 33, Sections D, E. A. S. Vinnell, Alhambra, \$7,992; L. A. Briscoe, Arroyo Grande, \$9,218. Contract awarded to Oilfields Trucking Co., Bakersfield, \$6,487.50.

SANTA BARBARA—Between Gaviota Pass and Santa Ynez River, about 2.8 miles, road-mix surface treatment and seal coat to be applied to existing shoulders. Dist. V, Route 2, Section D. Basich Bros., Torrance, \$7,112. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$6,052.50.

SANTA CLARA COUNTY—Between one mile and four miles east of Alum Rock Road, apply road-mix surface treatment. District IV, Route 115, Section A. Lee J. Immel, Berkeley, \$5,416. Contract awarded to Pacific Truck Service, Inc., San Jose, \$4,850.60.

SANTA CLARA COUNTY—Construct a gravel base and road-mix surface between 3½ miles East of Bell Station and Merced County line approximately 2.8 miles. Dist. IV, Route 32, Section C. Emberton-Schumacher Co., Albany, \$17,365; Pacific Truck Service, Inc., San Jose, \$18,178. Contract awarded to Lee J. Immel, Berkeley, \$16,969.

SHASTA COUNTY—Between Shingleton and 2.9 miles easterly, about 2.9 miles to be surfaced with imported borrow and road-mix surfacing and seal coat applied. District II, Route 29, Section E. Poulos & McEwen, Sacramento, \$29,710; Leo J. Immel, Berkeley, \$22,806; A. A. Tieslau, Berkeley, \$26,417; Piazza & Huntley, San Jose, \$26,600; Young & Son Co., Ltd., Berkeley, \$29,303; Guerin Bros., San Francisco, \$35,662. Contract awarded to Claude C. Wood, Lodi, \$22,760.

TEHAMA COUNTY—Between Proberta and Red Bluff, about 6.2 miles to be graded and paved with asphalt concrete and bridges to be constructed. District II, Route 7, Section B. Fredericksen & Westbrook, Sacramento, \$227,080; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$231,191; N. M. Ball Sons, Berkeley, \$233,523; Grandfield, Farrar & Carlin, San Francisco, \$237,312; Poulos & McEwen, Sacramento, \$240,421; A. Teichert & Son, Inc., Sacramento, \$243,718; Union Paving Co., San Francisco, \$247,857; Louis Baisotti & Son, Claude C. Wood and L. D. Tonn, Lodi, \$248,465; Marshall Hanrahan, Redwood City, \$248,671. Contract awarded to Piazza & Huntley & J. P. Brennan, San Jose, \$210,865.15.

TULARE AND FRESNO COUNTIES—Between Staffords Corner and South Fork of Kings River, about 47.3 miles road-mix surface treatment to be applied. District VI, Routes 129 and 41, various sections. Oilfields Trucking Co., Bakersfield, \$32,927; Maceo Construction Co., Clearwater, \$27,102; Basich Brothers, Torrance, \$22,956; J. E. Haddock, Ltd., Pasadena, \$41,464; Clyde W. Wood, Los Angeles, \$18,891; A. S. Vinnell Co., Alhambra, \$22,452. Contract awarded to Granite Construction Co., Ltd., Watsonville, \$18,747.04.

TULARE COUNTY—Between Yokohl and Lemon Cove, about 5.3 miles nonskid surface treatment to be applied. District VI, Route 10, Section D. Granite Construction Co., Ltd., Watsonville, \$4,138; A. S. Vinnell Co., Alhambra, \$4,349; Piazza & Huntley, San Jose, \$4,554; L. A. Briscoe, Arroyo Grande, \$4,570. Contract awarded to Stewart & Nuss, Inc., Fresno, \$4,034.80.

TULARE-KINGS COUNTIES—Between Tulare and 3 miles north of Goshen, between Hanford and Route 4, about 26.2 miles in length to be surfaced with crusher run base, plant-mixed surfacing and nonskid surface treatment. Dist. VI, Routes 4, 10, Sections FEA. Granite Construction Company, Ltd., Watsonville, \$31,949; L. A. Briscoe, Arroyo Grande, \$32,237. Contract awarded to Union Paving Co., San Francisco, \$30,823.90.

TULARE COUNTY—Across Sand Creek Channel, about 15 miles north of Visalia, a reinforced concrete slab bridge to be constructed. Dist. VI, Route 131, Section A. Victor L. and Wm. B. Jacobson, Los Angeles, \$5,400; C. C. Gildersleeve, Berkeley, \$5,482; James B. Anderson, Visalia, \$5,647; Thomas Construction Co., Burbank, \$5,847; L. D. Tonn, Lodi, \$5,890; R. Hodgson & Sons, Porterville, \$6,357; L. C. Seidel, Oakland, \$6,435; L. H. Hansen & Sons, Fresno, \$6,584; Midstate Const. Co., Fresno, \$7,183; A. S. Vinnell Co., Alhambra, \$8,132. Contract awarded to P. Fredenburg, South San Francisco, \$5,375.25.

VENTURA COUNTY—Between Ventura and Rancho El Rincon, about twelve and three-tenths miles in length, road-mix surface treatment to be applied. Dist. VII,

Route 2, Section D,E and F. Oilfields Trucking Co., Bakersfield, \$7,196; C. R. Butterfield-Kennedy Co., San Pedro, \$10,496; George J. Bock Co., Los Angeles, \$11,141; A. S. Vinnell Co., Alhambra, \$11,150; Oswald Bros., Los Angeles, \$11,562. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$6,637.

VENTURA COUNTY—About ½ mile southeast of Piru, a reinforced concrete slab and girder bridge to be constructed, consisting of seventeen 50-foot spans and two 15-foot cantilever spans. District VII, Route 79, Section C. Maceo Construction Co., Clearwater, \$80,507; Carlo Bongiovanni, Los Angeles, \$84,132; Griffith Co., Los Angeles, \$84,289; Martin & Schmidt, Long Beach, \$85,643; J. E. Haddock, Ltd., Pasadena, \$86,231; Byerts & Dunn, Los Angeles, \$86,619; Trewitt Shields & Fisher, Fresno, \$88,275; Paul J. Tyler, Oroville, \$88,956; Vinson & Pringle, Phoenix, Ariz., \$93,284; Gibbons & Reed, Burbank, \$93,281; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$102,165; Engineers, Ltd., San Francisco, \$102,905; A. S. Vinnell Co., Los Angeles, \$106,361. Contract awarded to J. S. Metzger & Son, Los Angeles, \$78,519.

VENTURA COUNTY—Between Buckhorn School and one mile southeast of Piru, about 1.8 miles to be graded and surfaced with plant-mixed surfacing. District VII, Route 79, Section C. Griffith Co., Los Angeles, \$70,150; Rhoades Bros., Los Angeles, \$71,134; A. S. Vinnell Co., Alhambra, \$80,766; Maceo Construction Co., Clearwater, \$81,485; C. O. Sparks & Mundo Engineering Co., Los Angeles, \$97,348. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$65,031.

YOLO COUNTY—Between Davis and Willow Slough and between Cache Creek and 2.2 miles north, about 6 miles retreat surfacing and seal coat to be applied. District III, Route 7, Section A. B. Granite Construction Co., Watsonville, \$25,074; Lee J. Immel, Berkeley, \$26,377. Contract awarded to E. A. Forde, San Anselmo, \$22,796.

YOLO AND SACRAMENTO COUNTIES—In Yolo County between Kiesel and Sacramento Weir and between Bryte and Broderick, and Sacramento County between Lincoln Way and Auburn Boulevard, about 10.6 miles existing pavement to be resurfaced with plant-mixed surfacing and armor coat. District III, Routes 50, 98, Sections F. A. Independence Construction Co., Ltd., Oakland, \$33,130; Fredericksen & Westbrook, Sacramento, \$42,137; A. Teichert & Son, Inc., Sacramento, \$29,560; Piazza and Huntley, San Jose, \$34,387; E. F. Hilliard, Sacramento, \$42,307. Contract awarded to J. R. Reeves, Sacramento, \$27,617.50.

YOLO COUNTY—On Yolo Causeway, about 2.7 miles metal guard rail, timber wheel guard and fire barrels to be painted. District III, Route 6, Section B. Al. W. Simmonds, Sacramento, \$3,400; Robert McCarthy, San Francisco, \$3,087. Contract awarded to Edwin Anderson, San Francisco, \$2,298.

YUBA COUNTY—Between ¾ mile west of Bruce's Corner and Dry Creek about 1.5 miles in length, to be graded and a bituminous seal coat applied. District III, Route 15, Section A. Fredericksen & Westbrook, Sacramento, \$28,207; Harms Bros., Sacramento, \$29,362; Young & Son Co., Ltd., Berkeley, \$29,649; Parish Bros., Los Angeles, \$29,808; Valley Const. Co., San Jose, \$30,808; A. Teichert & Son, Inc., Sacramento, \$31,545; Guerin Bros., San Francisco, \$36,387; Louis Baisotti & Son, Stockton, \$37,777; Claude C. Wood, Lodi, \$45,902. Contract awarded to Hemstreet & Bell, Marysville, \$24,532.10.

"Ollisher—hie, tell a policeman to call me a cop."

Sullivan Observes 25th Anniversary as Road Engineer

DISTRICT ENGINEER E. Q. SULLIVAN of District VIII, Division of Highways, with headquarters in San Bernardino, recently celebrated the twenty-fifth anniversary of his employment in the State highway service.

Following his graduation from the University of California in 1913, Mr. Sullivan was appointed Assistant Resident Engineer in District II on August 3, 1914. He worked progressively as superintendent and resident engineer on day labor and contract construction of roads and bridges until his appointment as Assistant District Engineer in 1922. On October 1, 1923, because of his experience and thorough acquaintance with every phase of highway activity, he was appointed District Engineer in San Bernardino when District VIII office was established, and has served in that capacity since.

A notable achievement in Mr. Sullivan's career was the location and construction under his supervision of a paved highway replacing the famous old plank road across the sand dunes of Imperial County, completed in 1926.

In 1923 Mr. Sullivan began a study of the desert road conditions and the "walking" sand hills on the border land route between El Centro and Yuma that seemed to defy efforts to build a permanent road to go through them. One group of experienced engineers declared that if the grade was low the blow sand would frequently bury the highway just as it did the old plank road. Another group insisted that if the grade was high the wind would blow the sand from under it.

Mr. Sullivan's studies of the movements of the dunes resulted in a plan to locate the pavement upon a grade line above the height of the surrounding dunes and prevent wind erosion of the embankment by oiling all shoulders and slopes to form an oiled cake.

Lawyer—"Are you positive this is the man who stole your car?"

Plaintiff—"I was before the witnesses began testifying. Now I'm not sure I ever had a car."—*The Live Oak*.

State of California

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Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

FRANK W. CLARK, Director of Public Works

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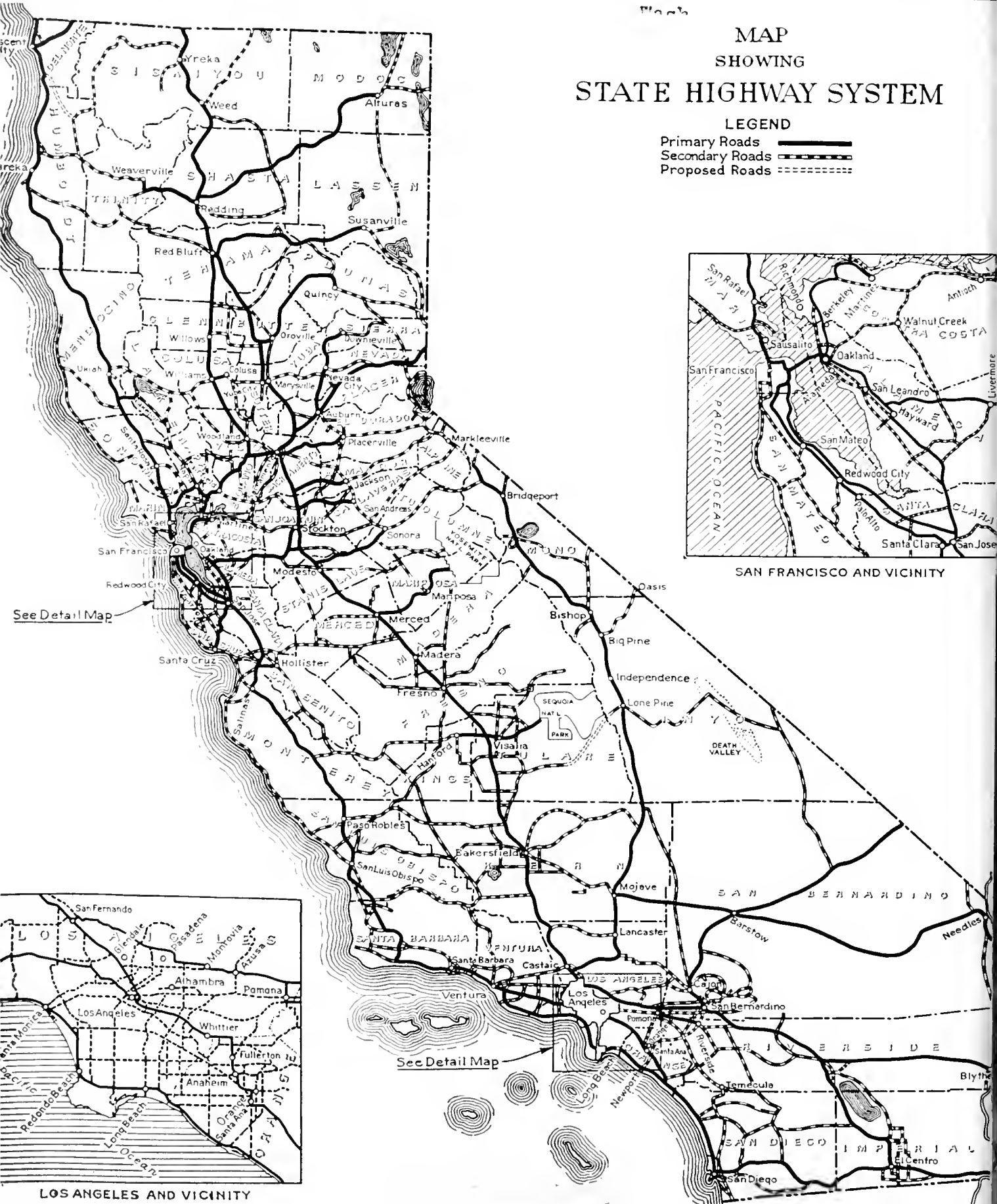
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Permit No. 152

MAP
SHOWING
STATE HIGHWAY SYSTEM

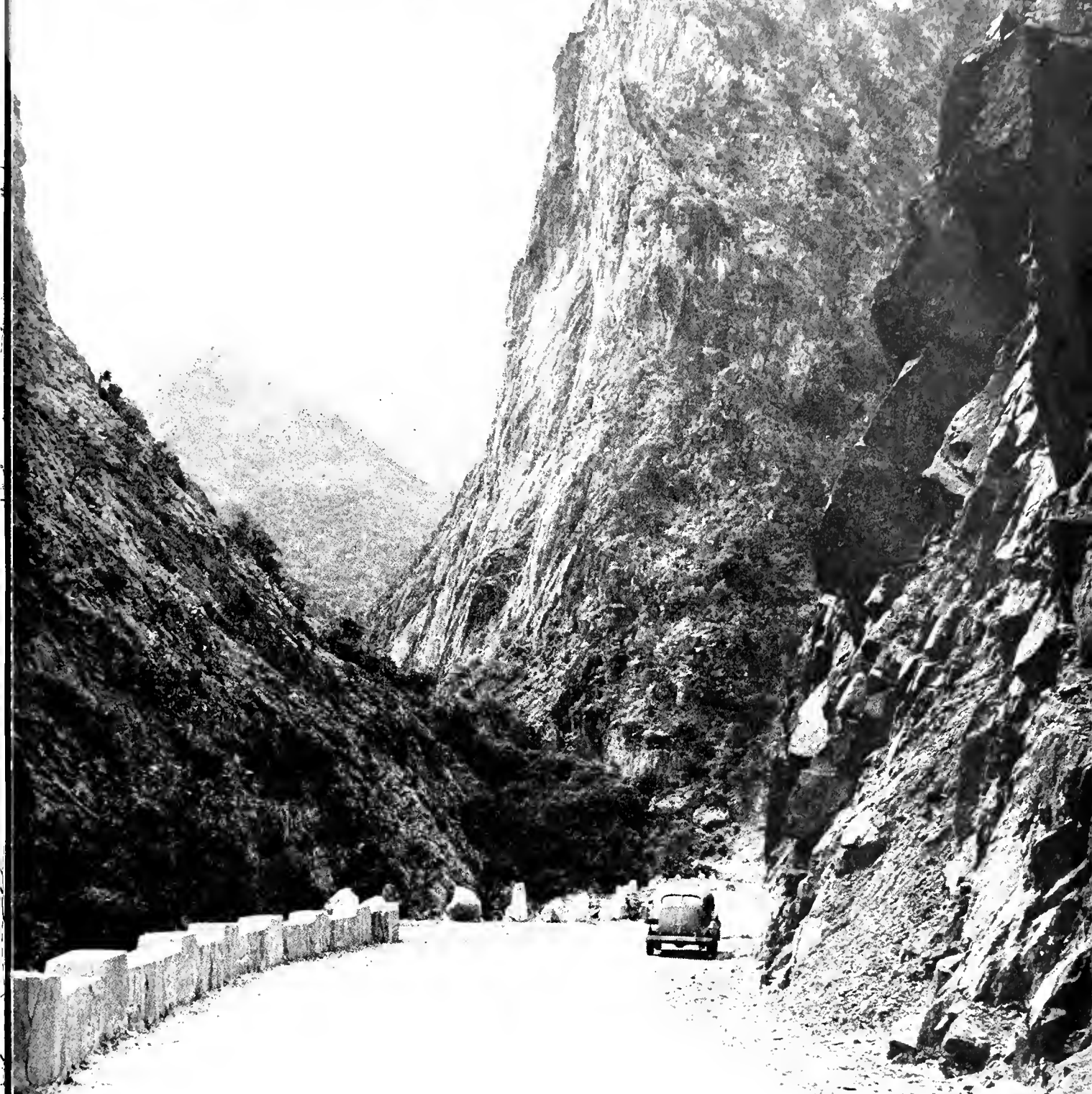
LEGEND

Primary Roads 
Secondary Roads 
Proposed Roads 



CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



SCENE ON NEWLY COMPLETED STATE HIGHWAY
IN KINGS RIVER CANYON, FRESNO COUNTY

OCTOBER
1939

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

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OCTOBER, 1939

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\$8,715,358 Low Bid Offer to Construct Friant Dam Wins the Contract Award

THE awarding on October 9th of the contract for construction of the \$16,000,000 Friant Dam by Secretary of the Interior Harold C. Ickes to the Griffith Company and Bent Company of Los Angeles, joint low bidders, is the most important event to agriculture and industry in the Great Central Valley of California since the contracts were let for construction of Shasta Dam.

Friant Dam is the second major unit of the Central Valley Project, which is elassed as the largest reclamation enterprise in history. The bid was opened in Sacramento by the United States Bureau of Reclamation September 14th, and brings well above the \$60,000,000 mark the contracts which have been already awarded by the Federal Government for construction of this project.

Ground breaking ceremonies at the dam site have been set for November 5, 1939. Awarding of the contract will bring a step nearer fruition the plan of the Central Valley Project developed under the direction of State Engineer Edward Hyatt, Department of Public Works, to provide a supplemental water supply for 1,200,000 acres of farm lands in the southern San Joaquin Valley.

This vitally needed unit of the Central Valley Project is located on the San Joaquin River about twenty miles north of Fresno. When completed it will provide storage capacity for 520,500 acre-feet of water, 316,500 acre-feet of which will be available for storage regulation of waters for delivery into the Friant-Kern Canal and the Madera Canal.

These canals, when constructed, will have an aggregate length of nearly 200 miles, one extending north from Friant Dam to the Chowchilla River north of Madera and the other south to a point near Bakersfield. They will carry a new water supply to parts of Fresno, Kern, Madera, Tulare and Kings counties. Surface waters in these sections long have

Friant Dam Bids

Five bids for the construction of Friant Dam, varying from a low of \$8,715,358.50 to a high of \$12,483,173.50, were taken under consideration by the United States Bureau of Reclamation which announced that a contract would probably be awarded before the end of October.

Walker R. Young, supervising engineer of the Central Valley Project, said work can be started on the big dam on the upper San Joaquin River by early November, provided the bids were found to be regular and satisfactory to the Government.

The proposals, opened Thursday, September 14, in Sacramento, were as follows:

Griffith Co. and
Bent Co., 418
S. Pecan St.,
Los Angeles... \$8,715,358.50

Shasta Construction
Co., San
Francisco ... 9,105,760.00

West Coast Constructors, Inc.,
Los Angeles... 9,197,169.50

Winston Bros.
Co., The Arundel Corp., D.
W. Thurston,
American Concrete &
Steel Pipe Corp., and L.
E. Dixon Co.,
Los Angeles 12,368,660.00

Friant Construction Co.,
San Francisco 12,483,173.50

The contractor will be allowed 1,200 calendar days, or about 3 years and 3 months.

been appropriated for irrigation purposes and pumping from thousands of wells has seriously depleted the underground supply. More than 40,000 acres of once producing farm land has been abandoned for lack of adequate water.

Due to the fact that the water supply naturally available to the San Joaquin Valley is insufficient to meet even present water requirements, and, in addition, that the waters now available are practically all utilized under rights established for many years, the furnishing of additional water needed to supply areas of deficiency in the southern San Joaquin Valley offered one of the knottiest problems which the State engineers had to solve in connection with the planning of the Central Valley Project.

When engineers of the State Division of Water Resources first began their studies of the state-wide water problem in 1921 they were faced with seemingly insurmountable climatic and geographic barriers. They found that roughly three-quarters of the State's water supply was in the northerly one-third of the State, whereas three-quarters of the ultimate demand was in the southerly two-thirds of the State.

To equalize this distribution is one of the primary objects of the Central Valley Project. By storing the waters of the Sacramento River watershed, which previously have run off into the Pacific Ocean as flood waters, a surplus will be made available for use in the San Joaquin Valley. This water, boosted up the valley by a series of pumping plants to Mendota, will serve to irrigate the lands which now draw on the San Joaquin River for water, thus releasing the stored water in the Friant Reservoir for distribution through the Friant-Kern and Madera canals.

Before such rearrangement of the existing water supplies could be brought about, however, many legal and water-right problems had to be

OCT 24 1939

Madera Canal
OutletOverflow
SpillwaySan Joaquin
River

Diagram Sketch of Friant Dam on Photograph of Dam Site Showing S

solved. During the last two years the U. S. Bureau of Reclamation has been negotiating with interested parties in the solution of these problems and the awarding of the contracts for construction of Friant Dam is a signal that satisfactory agreements have been negotiated.

The Friant Dam, which engineers have estimated will cost approximately \$16,000,000, will provide employment for 2500 men during the three years necessary to complete the unit. It will be 3430 feet long, 300 feet high and have a bottom width of 250 feet. In top length it compares favorably with the 3500 feet of Shasta Dam, now under construction on the Sacramento River at Kennett. However, Shasta Dam, with its 560 feet of height, is nearly twice that of Friant Dam. In plan, cross-sections, height and length it does not differ greatly from the Norris Dam in Tennessee or the Madden Dam in the Panama Canal Zone.

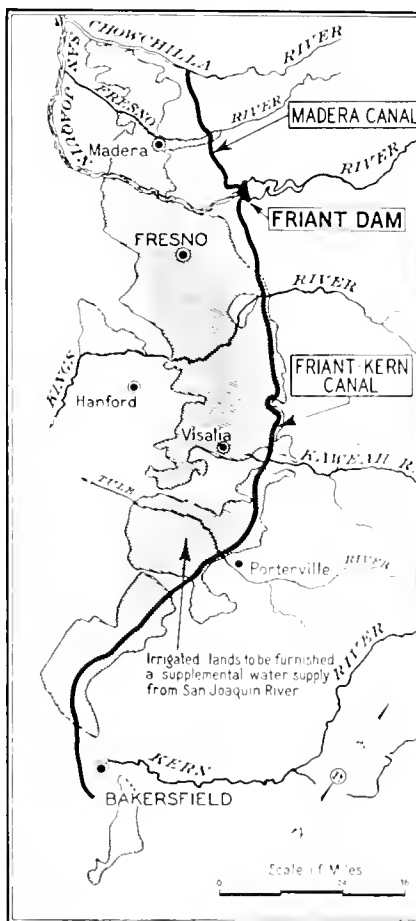
The dam will be of the gravity type and contain 1,850,000 cubic yards of concrete. It will be 250 feet thick at the base and 20 feet at the crest, with drum gates controlling an overflow spillway in the river section. This spillway will

provide three 100 by 18-foot outlet separated by 12-foot piers in which the operating mechanism for the drum gates will be housed.

The spillway design, which was tested by model studies, provides for a 90,000 second-foot capacity with an 18-foot depth of water on the crest of the dam.

Originally Friant Dam was planned as a 285-foot high structure, but studies made subsequent to the record-breaking floods of March, 1938, resulted in the addition of 15 feet to the structure thereby adding 70,000 acre-feet of storage for flood control purposes. Of the gross reservoir storage capacity of 520,000 acre-feet, the upper 15 feet, with a capacity of 70,000 acre-feet, will be for flood control. The next lower 316,000 acre-feet of capacity will be used for irrigation purposes and the remaining 134,000 acre-feet will be dead storage to permit diversion into the high line canals.

Diversion for the Friant-Kern Canal, which will eventually extend south about 160 miles to the Kern River west of Bakersfield, will be accomplished by four conduit through the left abutment section. These canal outlets will be controlled





Cross San Joaquin River and Locations of Spillway and the Canal Outlets

by four 96-inch hydraulically operated needle valves with a canal head capacity of 3,500 second-feet. Diversion of 1000 second-feet for the Madera Canal, which will supply the Madera Irrigation District, will be provided by two conduits through the right abutment of the dam controlled by two 78-inch hydraulically operated needle valves.

All outlets are provided with semi-circular trash rack structures on the upstream face of the dam, designed for velocities varying from two to four feet per second through the racks.

The site of the dam is in typical foothill country, and the San Joaquin River Canyon is broad at this point, as indicated by the 3430-foot crest length of the dam. First exploration of the site by core drilling and test pits was carried out by the Madera Irrigation District from 1918 to 1924. Investigations carried on at the site by the U. S. Bureau of Reclamation have included about 1000 feet of tunnels, 300 feet of shafts, nearly 4000 feet of diamond drill boring, and about 400 feet of 36-inch diameter core drilling.

The rock at the site is classified as schist, which in the unweathered state is relied upon for adequate

Construction Data on Friant Dam

Stripping Gravel Pit	600,000 cu. yds.
Excavation at Dam	770,200 cu. yds.
Concrete in Dam	1,850,000 cu. yds.
Concrete, Miscellaneous	57,280 cu. yds.
Drain Tile and Pipe	64,470 lin. ft.
Metal Tubing and Fittings	2,645,000 lbs.
Reinforcing Steel	3,300,000 lbs.
Gates and Conduit Lining	1,022,000 lbs.
Outlet Pipes	679,000 lbs.
Gate Frames and Trucks	497,000 lbs.
Trash Racks	646,700 lbs.
Needle Valves	1,087,000 lbs.

All materials are furnished by the Federal Government except small quantities incidental to installation work.

support. This rock is reasonably tight. The schist at the site rests upon a granite which extends to a depth and area beyond the boundaries affected by the dam. Bedrock is exposed, or near the surface, over the entire site. Sound rock will probably be reached by excavation

ranging from a minimum of about 10 feet to a maximum of nearly 80 feet. It is estimated that 770,200 cubic yards of excavation of all classes will be necessary.

Specifications provide that the contractor produce and process aggregate for the concrete in Friant Dam. The aggregate is to be produced from pits already purchased by the government about two miles downstream from the dam site.

Extra precautions have been taken in the preparation of plans for Friant Dam to insure that cracking, weathering and other disintegration of the concrete be minimized. They affect the temperature, composition and curing of the concrete.

In addition to the use of low-heat Portland cement, it is required that pumicite in the amount of about 20 per cent by weight of the cement be used for the mass concrete of the dam, except the outer six feet of the crest and the downstream slope of the spillway section.

Much emphasis is placed on temperature control to prevent cracking and other weaknesses. The limitations placed on the maximum allowable temperature of the mass concrete when deposited vary from a low of 58 degrees F. during Decem-

Governor Olson "Will Carry on Fight to Bring People Water and Power at Cost"

IN CONNECTION with the awarding of the contract for the dam construction, Governor Culbert L. Olson issued the following statement:

"The award of contract for construction of Friant Dam by the United States Bureau of Reclamation is another step forward in the construction of the great Central Valley Project.

It should be understood by the citizens of this state, that the administration in Washington which is making possible the construction of the Central Valley Project, has called upon us to be prepared to participate in the benefits of the project.

Both President Roosevelt and Secretary Ickes have urged the adoption by the state of a program which would provide public outlets for the water and power developed by the project.

At the last session of the Legislature my administration sponsored the bill which would have made this cooperation with the federal government possible.



GOVERNOR CULBERT L. OLSON

President Roosevelt and Secretary Ickes urged the passage of this measure so that they could be assured of full cooperation by the state in the future development of the project for the maximum benefit of consumers and the people of the Central Valleys.

The measure was bitterly opposed by the power trust representatives and finally defeated by a reactionary minority in the Assembly.

This can be considered only a temporary defeat.

The duty of the state to provide adequate outlets for water and power to be developed, will, I am sure, be responded to by the people by electing a Legislature that will perform that duty instead of obeying the behests of the power trust.

I expect to carry on the fight pledged in my party platform and in my inaugural address to bring to the people, at cost, through public agencies, water and power, which as natural resources, are their birth-right."

ber and January, to a high of 70 degrees F. during the months of June to September, inclusive.

The designs call for cooling pipes, through which river water may be circulated, to be embedded on foundation rock and on top of each five-foot lift of concrete, with the horizontal spacing varying from two and one-half feet at the base to five feet at the top. It will require 578 miles of one-inch pipe to supply this cooling system.

Other conditions at the dam are particularly favorable for the control of temperature due to the relatively high mean annual air temperature, low humidity in summer and low river water tempera-

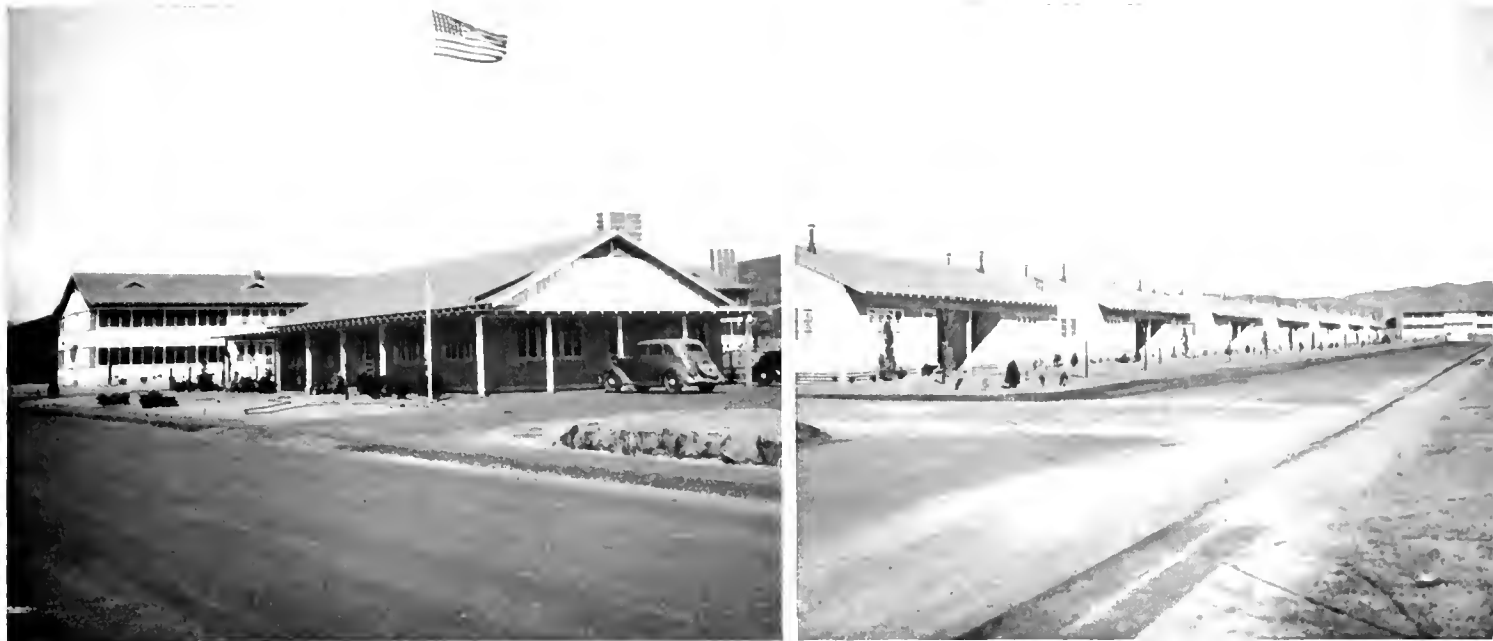
ture. Cooling is to be continued until the mean temperature of the concrete is within 8 degrees of the mean daily temperature of the river water.

The Friant Dam feature of the Central Valley Project is being constructed by the Bureau of Reclamation. John C. Page is Commissioner of Reclamation, and R. F. Walter, chief engineer. Walker R. Young is supervising engineer in charge of all field activities of the project, with headquarters at Sacramento. Roy B. Williams will be construction engineer in direct charge of the Friant division of the project, with headquarters at Friant.

Plans for a public celebration of the

start of construction of Friant Dam are being completed by Chairman James R. Fauver of the program committee of the Central Valley Project association working in conjunction with state officials and the United States Bureau of Reclamation.

General Patrick Farrell, adjutant general of the California national guard, has approved the dispatch of an artillery battery to Friant. The guns will be used to pay honor to Governor Culbert L. Olson and to the flag and to salute the start of construction by firing a salvo from the north abutment of the dam site. It is expected the construction contract will be awarded and work started by the date selected for the celebration



Friant Camp Scenes: Left—View of headquarters office and dormitory No. 1. Right—Duplex cottages on Second Avenue.

Communities Must Organize to Get Water and Power

By FRANK W. CLARK, Director of Public Works

THE awarding of the contract for construction of Friant Dam by Secretary Harold C. Ickes is a step forward in the development of the Central Valley Project of prime importance to the people of California.

It should serve to spur business, municipal and agricultural interests to immediate action in preparing to receive the water and power which will be developed by the project.

The Federal government, through the Bureau of Reclamation, already has committed itself to expenditures of more than \$60,000,000 and approximately 3000 men are now employed in actual construction work. The contract for construction of Friant Dam as awarded will bring the government's obligation to well above the \$75,000,000 mark and increase the number of those employed to 5000.

The completed Central Valley Project will make available over 2,000,000 acre-feet annually of new water supplies for industrial, municipal and irrigation uses in the Sacramento and San Joaquin Valleys, enhance navigation, control flood waters, and develop from one billion to



FRANK W. CLARK

one and a half billion kilowatt hours of electric energy for use in the Cen-

tral Valley project system.

Although the primary object of the project is the solution of California's pressing water shortage problems, the hydro-electric development is of vital importance to future users of that water. The sale of this power through public agencies will not only save many millions of dollars to the general public but will also provide sufficient revenue to make cheap water available for irrigation and industrial purposes.

Funds advanced by the Federal government for construction of the project must be met with revenues received from the sale of water and power. The Federal government, however, makes no provision for the distribution of these facilities. It therefore devolves upon state and local agencies to take the necessary steps to provide these facilities and have them ready when the main units of the project are completed.

Local agencies can, and should, start now to prepare the way to receive this cheap water and power through the formation of the necessary districts.

The backbone of these organizations should be the municipalities, farm districts and industries that will

(Continued on page 19)

\$500,000 Expenditure Entailed by Storm Damage to Highways in South

By E. E. WALLACE, District Engineer

THE desert country in Riverside and Imperial counties is ordinarily thought of as a land of continual sunshine and drought, but as demonstrated during the storms of September this same country occasionally encounters even more severe rain storms and storm damage than other sections of the State.

But torrential rains last month washed out 35 miles of highway, approaches to six bridges and a number

The estimated cost of placing the damaged highways in condition to again carry traffic, without any improvement or additional protection, is \$120,000 alone.

In order to meet the emergency, Director of Public Works Frank W. Clark has requested the U. S. Bureau of Public Roads for Federal Aid funds in the sum of \$250,000, promising that the State will appropriate a like amount.

that extended throughout all of the northerly end of the Colorado Desert from Indio to Arizona. This was followed with steady rain all of the remainder of September 4th, 5th and 6th, during which time concentration of considerable intensity occurred at Shavers Summit and easterly from Desert Center to and along the Colorado River. This storm shifted south through Imperial Valley on the 5th and 6th, resulting in a general rain of



Cloudburst flood scene on Jackson Street in City of Indio, Riverside County, during storm of September 4th

of protective dykes between Indio and Blythe on U. S. 60 and 70 (State Route 64). Extensive damage was also done on U. S. 95 and 99 and State routes 111 and 195.

Restoration work, urgently needed protection construction and rebuilding of the damaged highway to a standard that will safeguard it against future storms of the intensity of those which wrought destruction in September will cost approximately \$500,000.

The torrential rains in the desert region usually occur during the late summer months, in August and the early part of September, and quite frequently follow a very oppressive hot period. When such rains occur, they are usually of cloudburst proportions, covering only localized areas.

But on September 4th an exceedingly heavy rainfall occurred in the Coachella Valley, centering near Indio,

such intensity as has not heretofore been recorded.

The heaviest rainfall for this storm was reported in Brawley, where a total of 6.43 inches of rain fell in approximately 24 hours. This is three times the average annual rainfall for that vicinity.

The agricultural section of Imperial Valley is not benefited by any rainfall as it is entirely dependent upon

irrigation and a storm such as occurred in Imperial Valley on September 5th and 6th causes an immense amount of damage in the destruction of many structures and canals, as well as injury to crops. It has been estimated that this single storm damaged the irrigation system of the Imperial Irrigation District to the extent of approximately a quarter of a million dollars.

A great deal of damage also occurred to the Southern Pacific Railroad, which travels both Riverside and Imperial counties diagonally on the north side of the Salton Sea. Many washouts occurred on the Southern Pacific main line between Indio and Ogilby and train service was completely stopped for two or three days, and seriously interrupted for a longer period of time.

ALL HIGHWAYS DAMAGED

The breaks in the canal system and in the railroad embankments, in addition to the heavy rains, poured large volumes of water onto the State and county highways at various locations and resulted in considerable damage to all of the highway systems in both Riverside and Imperial counties. Though portions of all of the main State highways in these counties were flooded at times, traffic was not seriously delayed on either U. S. 80 or on U. S. 99.

Southern Pacific passengers were transferred to busses at Indio and taken to El Centro or other railroad points where they were again transferred to the trains.

Traffic was completely stopped on State Route 111 along the north shore of the Salton Sea and adjacent to the Southern Pacific tracks, and on U. S. 60 and U. S. 70 between Indio and Blythe, where traffic was completely stopped for a period of five days, due to at least half a dozen serious washouts.

COMPLETELY WASHED OUT

State Highway 195 from Mecca through Box Canyon to Shavers Summit was completely washed out, following repairs which had just been completed on storm damage that had occurred in July.

U. S. 95, extending northerly from Blythe along the Colorado River, was completely closed to traffic for two weeks, due to loss of embankments through all of the major arroyos.



Havoc to roadways on U. S. 195 extending north from Blythe to Needles along Colorado River closed it to traffic for 2 weeks.



No. 4—State maintenance equipment marooned by flood. 5—Auto washed down stream off highway. 6—Long stretch of U. S. 60 carried away.

The most serious damage occurred on U. S. Highways 60 and 70 between Desert Center and Blythe. Through this area exceptionally heavy rainfall occurred, resulting in great sheets of water flowing to the north across the highway into old dry lake areas. The soil in that vicinity is of a silty and sandy nature which erodes very rapidly and the huge volumes of water destroyed the ditch and dyke system which had been constructed to lead water to the several bridges, releasing water across the highway and depositing volumes of mud and debris.

MAINTENANCE CREWS MAROONED

State maintenance crews were on the job early Monday morning as soon as the storms started, and though several State tractors and graders were marooned in the storm-swept areas, all available State equipment and 43 pieces of rented equipment, including 12 large tractors with bulldozers, 11 power shovels, 16 large trucks and other miscellaneous equipment, were immediately assembled and put to work cleaning off the highways, filling in the washed-out areas and making repairs as rapidly as possible in order to restore the highways to a condition where they could again carry traffic.

Detours were constructed around all of the destroyed bridge approaches, and the traffic which had been marooned at Blythe and Desert Center was permitted to pass through as soon as a one-way road could be opened.

On the morning of September 25th, while repairs to the highway were still intensively under way, another storm of clondburst intensity hit in the Coachella Valley just south of the highway. Water one and a half feet deep flowed through Indio and along the railroad and highway through Coachella and Thermal. The Southern Pacific tracks were again washed out south of Indio and train service was interrupted temporarily.

Considerable damage occurred on U. S. 99 by erosion of the embankment shoulders between Indio and Oasis, and some damage occurred on the Palms-to-Pines Highway west of Indio.

A rainfall of over 6 inches occurred within a few hours during the storm

(Continued on page 19)



Three and a half mile stretch of four-lane divided highway recently opened with appropriate ceremonies on Foothill Boulevard in Alameda County has 23 feet of roadways on each side of 24-foot, planted division strip

New Divided Highway Unit Completed

ADDING another unit of four-lane divided highway to State Route 5, the main traffic artery between the East Bay area and the San Joaquin Valley, the realigned highway between San Leandro and Castro Valley on the Foothill Boulevard in Alameda County was formally dedicated to public service on Saturday morning, September 16.

The improvement cost \$309,500 and will greatly facilitate motor vehicle transportation between Alameda County and the San Joaquin Valley and south to Los Angeles.

Dedication ceremonies were held under the direction of community leaders from Hayward, Oakland, San Leandro and Castro Valley, and were followed by a luncheon at the Green Shutter Hotel in Hayward.

Official opening of the new highway was signalized when State Highway Commissioner L. G. Hitchcock of Santa Rosa and Supervisor Tom E. Caldecott cut a ribbon stretched

across the roadway at the junction of Foothill Boulevard and the Castro Valley Cutoff. City Councilman Robert A. Kolze of Hayward was master of ceremonies at the luncheon.

The new stretch of highway is 3.5 miles in length with two lanes on each side of a 24-foot dividing strip. The lanes adjacent to the dividing strip are of asphalt concrete, twelve feet wide, and the outside lanes are 11 feet wide, of Portland cement concrete with 8-foot, oil treated shoulders.

Speakers for the dedication ceremonies and luncheon in addition to State Highway Commissioner L. G. Hitchcock included I. B. Parsons of Hayward, of the State Chamber of Commerce Central Coast Highway Committee; John Deadrich, member of the San Leandro Chamber; Ralph H. Anderson, Hayward Chamber, president; Supervisor Caldecott, Mayor Arthur E. Manter of Hayward.

Col. Jno. Skeggs, District Highway

Engineer, representing Frank W. Clark, Director of the State Department of Public Works; Dave Kidd, Castro Valley; A. J. Olivera, San Leandro Chamber, president; Claude Faw, of the State Chamber; Earl Leonard of the Oakland Chamber; Irvin B. Wright, assistant manager, State Chamber.

Joseph King of Hayward was the contractor.

43,819,929 Automobiles on World's Roads

World automobile registrations, as of January 1, 1939, totaled 43,819,929 units. The gain over the previous year was 741,299 units, or 1.7 per cent, according to the U. S. Department of Commerce. Sixty-eight per cent of all the motor vehicles in use are registered in the United States, but last year's advance was in other countries, which gained 13 per cent in passenger cars and six per cent in trucks.

Ocean Shore Highway Realignment Eliminates 133 Curves in 10 Miles

WITH officials and citizens of three counties participating, dedicatory ceremonies celebrating the opening of the Davenport-Waddell link of the Ocean Shore Highway connecting Santa Cruz with San Francisco were held in Davenport on Sunday, September 15.

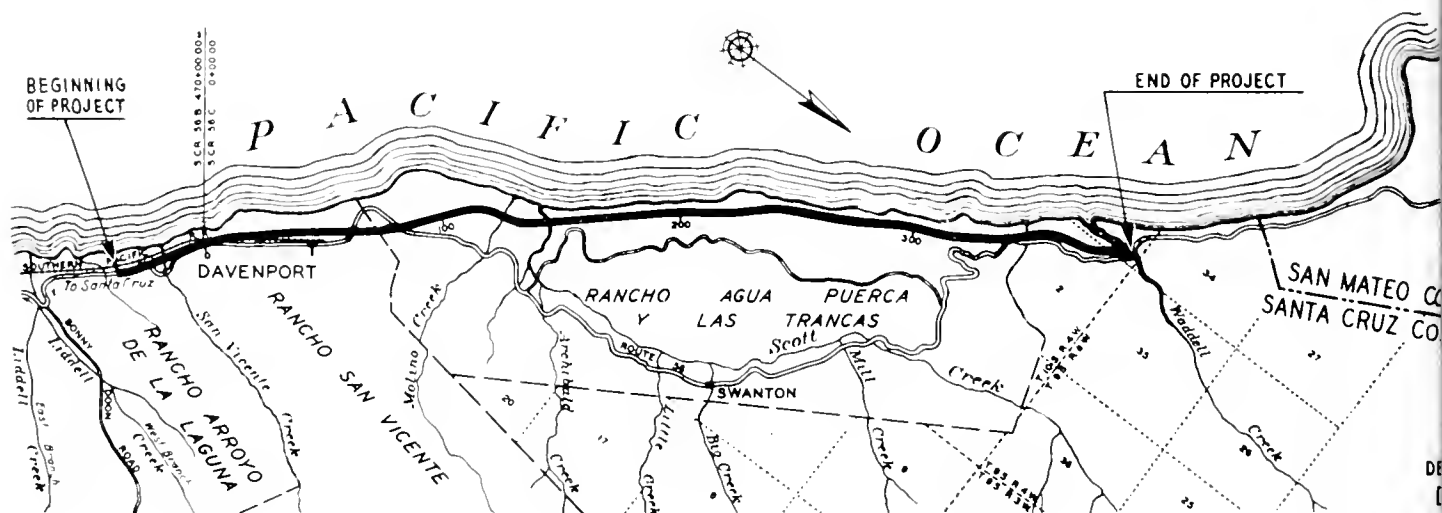
Directors of Joint District No. 9, composed of San Francisco, San Mateo and Santa Cruz counties, joined with State and local dignitaries in hailing completion of the new stretch of highway which, with projects completed between Rockaway Beach and Half Moon Bay and

the shore of the Pacific Ocean along nearly one-half the coast line of California. In Santa Cruz County the route follows the ocean shore from Watsonville through Santa Cruz, thence northerly through Davenport into San Mateo County at Point Año Nuevo and through the towns of Pescadero, Half Moon Bay and Rockaway Beach.

The portion of the route in Santa Cruz and San Mateo counties is destined to become a most important recreational, and to a large extent commercial, highway for the San Francisco Bay area. The Depart-

the bluffs along the ocean shore. From these bluffs, rising to heights of 50 to 200 feet above the water, may be had magnificent views of the Pacific and its rugged coast.

The old road was built by Santa Cruz County in 1852 and conformed to the standards of that day. Even with maintenance and some improvement the roadbed, at the time construction on the present contract was begun, was from 20 to 24 feet wide and the width of the traveled way was only 14 feet to 16 feet. The alignment consisted of many sharp curves and the grade line rose and



Heavy black line shows direct route of new unit of Ocean Shore Highway north of Santa Cruz compared with winding old road

over Pedro Mountain, constitutes the third major unit of what ultimately will be one of California's most scenic routes.

Supervisor John Ratto of San Francisco, as chairman of Joint Highway District No. 9, was master of ceremonies at Davenport, where a luncheon at the Ocean View Hotel was a feature of the celebration.

A contract for construction of the Davenport-Waddell link of the Ocean Shore Highway, State Sign Route 1, was awarded by the Department of Public Works on November 14, 1938.

The Ocean Shore Highway skirts

ment of Public Works has for the past several years been advancing major construction projects along portions of the road near San Francisco, such as that between Half Moon Bay and Rockaway Beach and the construction of the road over Pedro Mountain. Major improvement of the portions of the route in Santa Cruz County has begun with the contract now completed between Davenport and Waddell Creek.

The location of the highway between these two points lies for the most part along the bench of Monterey shale which extends from the base of the Santa Cruz Mountains to

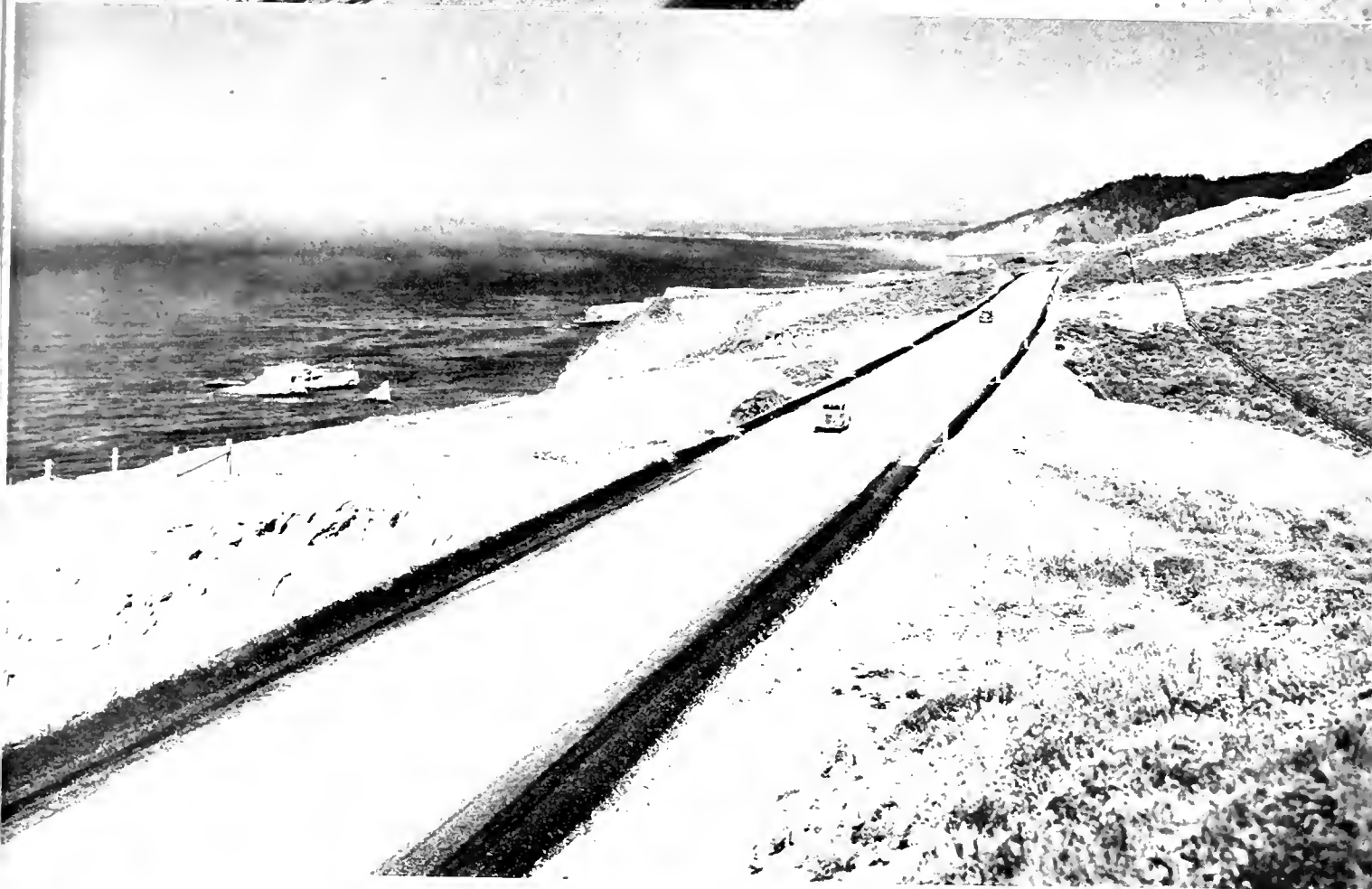
fell from elevations of 15 feet to 510 feet.

The new road as laid out and constructed by the Division of Highways is based on modern standards adequate for the demands of present day traffic.

Comparison of these standards to those of the old road gives striking evidence of the progress in highway construction during the past 85 years.

The length of section just completed is 8.2 miles and the old road wound for 10.3 miles between the two points limiting the contract.

(Continued on page 17)



Two views of sections of new State highway along the ocean north of Santa Cruz between Davenport and Waddell Creek.

Laws Passed by 1939 Legislature Affecting State Highway System

By C. C. CARLETON, Chief Attorney Department of Public Works

THE 1939 session of the California Legislature continued the general policies indicated in previous sessions, of carrying on the State highway program in substantially the same manner as has been practiced for a number of years.

The complete absence of legislation of a type inimical to the carrying forward of the State highway program and the passage by the legislature and approval by Governor Culbert L. Olson of the measures hereinafter described, indicate the extremely favorable consideration accorded to all of those who are interested in progressive State highway legislation.

The 1939 legislation, unless otherwise specifically provided in a particular chapter, took effect on September 19, 1939.

The limitations upon the length of an article of this kind prevent discussion of every bill of interest to the Division of Highways, as a great many measures which affect State government generally apply to the work carried on by the Division of Highways. There was a considerable volume of such legislation but in this article reference will be made only to that legislation which is of primary relationship to the highway program.

HIGH-TYPE HIGHWAYS ENCOURAGED

There were three laws enacted which should prove of inestimable value in carrying on California's program of developing high-type highways adequate to care for the ever increasing volume of traffic, particularly on our main line routes and in and around the metropolitan centers of the State.

CHAPTER 687.—This statute is a definite step forward, placing this State among the highway leaders of the states in the Union. This chapter recognizes a freeway as a new type of highway to which abutting property shall have no right of access. Under the new law, the department



C. C. CARLETON

is authorized to acquire the necessary rights of way and rights of access from private property to construct and maintain such freeways. The intersections of local city streets or county roads with such freeways can be regulated or eliminated by agreement with the local authorities. New intersections of local streets or highways with freeways can not be made without the consent of the California Highway Commission.

While Chapter 687 authorizes the State, in connection with State highways, to construct such freeways, Chapter 359 authorizes cities likewise to construct freeways. State highways can not be affected by such freeways without the consent of the Highway Commission.

CHAPTER 268.—Authorizes the construction of divided highways either on existing roads or on new

openings. In addition, this law authorizes the construction of service roads along the sides of existing State highways or new highways to be constructed. Crossing the central dividing strip or the physical barrier between the service road and the main portion of the divided highway will be prohibited except at such locations as are provided.

CHAPTER 684.—Authorizes the Department of Public Works with relation to State highways to adopt a distinctive marking to be placed in the center of State highways over which it will be unlawful to cross. The department by an order of the Director of Public Works, Frank W. Clark, has adopted the double line now in use as such distinctive marking under the authority of this law.

While a freeway divided in the center into two distinct roadways for traffic traveling in opposite directions constitutes development of the highest type, it is recognized that the cost of constructing such highways over any considerable mileage would be prohibitive, and the other two measures are designed to permit the building of highways approaching that principle without incurring the heavy cost involved in the construction of an absolute freeway.

STATE HIGHWAY ROUTES

The legislature continued its policy of the last three sessions of refusing to permit any wholesale additions to the State highway system. Only those highways, the inclusion of which was acceptable to the department, were included within the system.

CHAPTER 473. Makes many minor changes in the descriptions of the various routes. This bill was introduced and passed at the request of the department to take care of those necessary changes in descriptions caused by relocations.



Sunken section of Arroyo Seco Parkway a 6-lane freeway with parallel service roads and no grade intersections as authorized by legislature, now under construction between Los Angeles and Pasadena.

CHAPTER 794. Adds some four miles from the Pacific Highway to the site of the new Shasta Dam. Due to the immense amount of interest being displayed by the public generally in the Central Valley Project, it was deemed necessary to provide an adequate highway to the site of the dam.

CHAPTER 338. Adds a new route from Canby to Merrill in Modoc County, to take effect only when the highway between these two points has been constructed to an adequate standard by the Federal Government.

HIGHWAY WORK GENERALLY

No major change was made in the method of performing highway work. The practice of doing major construction work by contract after competitive bidding remains unchanged. Certain minor changes, however, affecting construction work were made.

CHAPTER 224. Amends the State Contract Act to permit the doing of work by day labor in cases of emergency due to the failure of bridges or other structures without the necessity of first preparing complete plans, specifications and estimates of cost. This chapter also

makes it clear that the other divisions of the department (Architecture and Water Resources) may use unit basis contracts in performing their work. The Division of Highways has used this type of contract for many years.

CHAPTER 315. Clarifies the relationship between the State Reclamation Board and the Division of Highways in so far as highway structures across waterways under the control of the Reclamation Board are concerned. Under the bill plans for all highway structures across streams, channels or basins under the jurisdiction of the Reclamation Board will be submitted to that board for approval. When such plans have been approved by the Reclamation Board and the project completed in accordance therewith, the Reclamation Board can not force a change in design without being ready to bear the expense thereof.

CHAPTER 264. Covers a number of matters. It clarifies the authority to construct and maintain stock trails. Minor changes are made in the procedure to be followed in renting equipment. Minor changes in our system of accounting are authorized which should greatly simplify that work. Changes are also made

in clarifying the rights and obligations of the State in so far as changing the grade of State highways is concerned.

CHAPTER 595. Authorizes permission to be granted to the State Highway Engineer to take outside employment from local governmental agencies.

CHAPTER 1121. Makes a number of minor amendments to the Outdoor Advertising Act, all designed to clarify the provisions of the act, and to render its enforcement more efficient.

FISCAL AFFAIRS

No major changes were made either in the revenues available for highway purposes nor in the apportionment of available funds.

CHAPTER 681. Permits a slightly broader use of the revenue from the Diesel fuel tax.

CHAPTER 1042. Provides for the escheat to the State Highway Fund of the unclaimed excess tolls collected by the Carquinez Bridge pending the litigation which followed the order of the Railroad Commission reducing tolls on the bridge.

CHAPTER 897. Authorizes the disbursing officers of the various de-

(Continued on page 24)



Realignment of Russian River-Gravenstein highway between Guerneville and Monte Rio in redwood recreational area of Sonoma County provides a beautiful drive along the river.

Realignment of Russian River Highway Opened With Ceremony

OPENING a new scenic region in the Russian River recreational area, the \$250,000 unit of the Gravenstein-Russian River Highway from Guerneville to Northwood was dedicated on Sunday, September 17, with appropriate and picturesque ceremonies.

State officials joined with Sonoma County and representatives of the Redwood Empire Association and the Russian River Recreational Region, Inc., in celebrating the occasion.

The new highway, 3.23 miles in length with a 36-foot pavement and wide, sweeping, safe curves, replaces an old, obsolete and dangerous road. There are long, straight-away stretches through groves of redwood on the new roadway, portions of which skirt the Russian River, affording motorists a clear view of the stream with its bathing beaches on one side and sum-



Supervisor Guidotti (left) hands axe to Highway Commissioner Hitchcock to sever redwood barrier.

mer homes among shaded forests on the other side.

The realigned highway follows the old roadbed of the Northwestern Pacific railroad. Sturdy retaining walls constructed of 12-inch "H" steel beams lagged with 6 by 12-inch timbers and anchored with steel rods provide secure embankments for the highway fills that replace some 1230 feet of abandoned railway trestles.

Other construction features are two concrete deck bridges. One is across Hulbert Creek at the entrance to Guerneville Park. It adjoins a concrete bridge, making a two-way divided structure 177 feet long. A second bridge is across Pife Creek and is 127 feet long.

For many years the region through which the new highway runs was devoted to commercial lumber activities on a huge scale. Gradual development of the area

as a playground and summer home and resort section increased motor traffic which rapidly outgrew the highway facilities.

To meet this situation, the Russian River Recreation Region, Inc., and the Sonoma County board of supervisors, led by Chairman E. J. Guidotti, worked out a program with the California Highway Commission under which Sonoma contributed \$20,000 to help pay construction costs of the Guerneville-Northwood project.

Dedication ceremonies began in Guerneville at 10.15 Sunday morning with the assembling of a motor caravan which proceeded over the old road to Monte Rio and then returned to Northwood where a barrier of redwood tree trunks and boughs was cut away by Highway Commissioner L. G. Hitchcock of Santa Rosa, signaling the official opening of the new highway. A luncheon was served in Guerneville Park.

Officiating for the State at the dedication were Commissioner Hitchcock, representing Governor Culbert L. Olson and Director of Public Works Frank W. Clark; Amerigo Bozzani of Los Angeles, member, and Byron N. Scott, secretary, of the Highway Commission; District Highway Engineer John H. Skeggs and Assistant District Engineer Paul Harding, San Francisco; and Senator Herbert W. Slater of Santa Rosa.

The Redwood Empire Association was represented by President Paul E. Mudgett, Vice-President Harold B. Rosenberg, M. Goldman and other officials. President Harry Harris and Secretary R. W. Miller of the Russian River Recreational Region, Inc., together with other officials of that organization, participated.

Civic groups were represented by Carl Hess, president, and Lee Torres, secretary, Monte Rio Chamber of Commerce; Ernest Johnson, president, and Henry Brown, secretary, Guerneville Chamber of Commerce; Henry Laws, president, Marguerite Fuller, secretary, and J. P. Kelly, chairman of the Highways Committee, Associated Chambers of Commerce of Sonoma County. The Golden Gate Bridge District was represented by two of its directors, Frank P. Doyle and Joseph Berry. Interesting, informative talks were made by several luncheon speakers.



Beautiful vistas through the redwoods greet the eye on new highway

Pomona Grade Separations Involve Channelized Ramp Approach System

By J. H. OBERMULLER, Assistant Engineer of Surveys and Plans

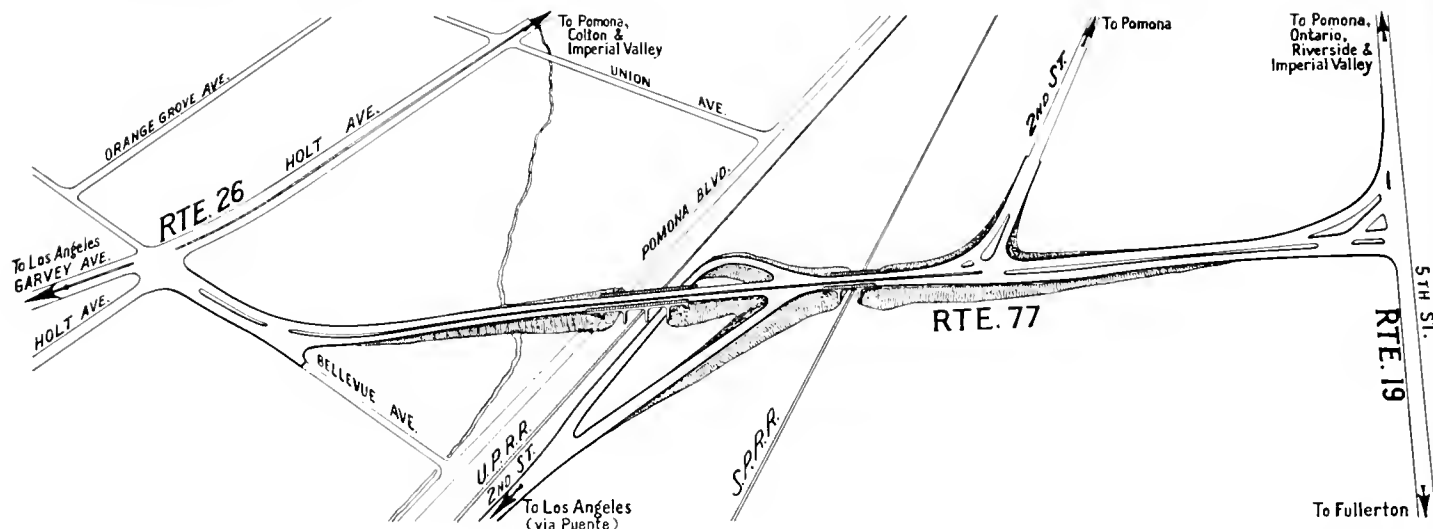
CONSTRUCTION has started on a grade separation project on State Highway Route 77, west of Pomona in Los Angeles County whereon the roadway approaches to the structures over two adjacent railroad lines consist almost wholly of interconnected channelized ramps and intersections.

The project is not long. Its termini each side of the railroad crossings bring the entire length of the project within the limits eligible for Federal grade separation funds. Nevertheless its design assumed importance be-

State Highway 77 as an extension of the Los Angeles-San Diego Inland Route crosses these rail and road facilities and although the West Pomona grade separation project is temporarily an isolated unit of the eventual development of Route 77, it does define the permanent location for this part of the route and does fulfill a requirement of long standing for connecting other highways and the alternative street routings through Pomona. It eliminates the necessity of through traffic crossing the railroad tracks in Pomona by substituting

Pomona on the south side of the railroads after collecting the traffic on the Valley Boulevard from Los Angeles and the traffic from the southeasterly metropolitan areas. Route 19 continues east past Ontario and Riverside to join Route 26 at Beaumont.

Topographic features west of Pomona are responsible for the convergence of rail and highway locations and they also influence the takeoff of Route 77 in the latter's southeasterly course to meet available routing toward San Diego. The selection of the site of the current project estab-



Grade separations over adjacent railroads and a city street on State Route 77 connected by channelized ramp approach system.

cause of the significance of highways correlated by this single unit of an ultimate relocation of Route 77 through the city of Pomona.

Two railroad crossings are involved over lines of the Southern Pacific and Union Pacific. With tracks not widely separated the railroads constitute definite highway control in that vicinity and the effect extends through and on each side of Pomona by splitting the city development and highway traffic. As a consequence major east-west traffic and interchange between important highway routes has been discouraged.

a separation for one grade crossing and permitting the closure of another one.

The principal east and west routings through the city are Route 26, Route 19 and the Second Street routing to and from the business section of Pomona. Route 26, locally called Holt Avenue, lies north of the railroads and is being developed on freeway principles to serve as one of the heaviest traveled direct arterials between Los Angeles and the Imperial Valley via Pomona and Colton.

Route 19 (Fifth Street) and the Second Street routing pass through

lishes connections at a point and in a manner that will greatly facilitate traffic movement without prejudice to existing conditions and with relief to through traffic and local requirements.

The plan separates crossing of the railroads by overheads on each line. An existing overhead structure of the Union Pacific is utilized by widening it and determines the structure crossing the nearby Southern Pacific tracks. Subway construction would be less satisfactory because of adverse drainage conditions and the danger of flooding from low adjacent territory.

The existing Union Pacific struc-

Ocean Shore Highway Realignment Eliminates 133 Curves in 10 Miles

(Continued from page 16)

ture is 115 feet long with 40-foot roadway. Widening will provide two 35-foot roadways with four-foot dividing strip and sidewalks. In widening, the existing walks are to be removed and a slab section added carried on three continuous reinforced girders which frame into two column bents.

Columns are set on individual spread footings and bents are keyed into top of the original structure. The widened portion has three spans with cantilever extensions. The structure is on 30 degree skew and provides for two railroad tracks.

The structure over the Southern Pacific railroad will be reinforced concrete 233 feet long with two 25-foot roadways each side of a 4-foot dividing strip and with sidewalks. It will provide for four railroad tracks and one of the highway ramps. Due to track location and highway ramp, interior spans have unequal length. The structure has seven girders and is of the stiff frame type except that girders are set on rockers at end bents. The girders frame into columns set on spread footings. Collision walls connect columns along the tracks and extend to a height of seven feet.

The roadway approaches and connections are almost entirely on fill sections. On main routing the roadways are separated by curbed dividing strip or by widened islands at intersection channelization. These roadways have a 23-foot pavement plus gutters where adjacent to curbs. Seven-foot shoulders and berms are provided on normal sections.

Between the two structures outside curbs connect structure curbs with shoulders extended for walkways. Extra lanes each side have been provided as extensions of the ramp connections giving six-lane width for an appreciable distance to facilitate traffic movement.

The connections to Second Street on both sides of Route 77 are made by ramps on which 26-foot width of roadway between curbs will carry one-way traffic. The westbound ramp from Route 77 passes under one of the overhead structures.

The connection to Fifth Street (Route 19) is made near ground level. Each roadway for one-way traffic has 23-foot pavement width and standard shoulders. Part of the Fifth Street intersection design is subject to future revision when Route 77 is extended by construction south of Route

While a saving of 2.1 miles may not seem particularly significant, it is nevertheless approximately 25 per cent of the distance.

On the old route there were 150 curves in the ten miles with a total curvature of 5300 degrees and the minimum radius of the curves, which determines their sharpness, was 55 feet. On the new alignment there are only 17 curves with a total curvature of 270 degrees. This reduction of 133 in the number of curves carries with it a reduction of 5030 degrees of curvature.

The minimum radius for curves used on this project is 2000 feet, which is the state standard for modern alignment.

19. For the present there is required provision only for traffic to and from Route 19 with most of the movement to and from the east. The design was planned to give freedom to this major current movement but curbs have been omitted where future changes may be made.

At intersection points or connections a system of island channelization has been laid out. Recessed curbs are used and a full complement of reflector buttons, flasher lights and electroliers are provided at essential sites. Several minor separation points will temporarily have painted islands pending observation studies of traffic for decision on the advisability of constructing small additional islands. Proposed signing for the various traffic movements became, as usual, an important factor in laying out the channelization.

When this improvement is completed there will be removed or greatly improved the existing difficulties and hazards for both through and local traffic passing into or through Pomona vicinity on north and south sides of the railroads. All movements on the State routes, the several county laterals and the local city streets are consistently served.

The construction contract has been awarded to John Strona, Pomona, California. The construction cost is \$214,000.

As on all new construction the grade line is smooth and the steep pitches and rolling grades have been eliminated. The highest point reached by the new road is only 213 feet as against the former 510 feet.

Construction operations on the project required the excavation of over 500,000 cubic yards of earth in the roadway prism. As the native material had been found unsuited for mixing with liquid asphalt for surfacing it was necessary to place 9500 cubic yards of imported surfacing material. This material was placed 22 feet wide and 1.17 feet deep on the 36-foot graded roadbed. The road-mix surface treatment required 1850 tons of liquid asphalt.

Provision for adequate drainage required the placing of 6000 lineal feet of corrugated metal pipe culverts and 4300 lineal feet of perforated metal pipe underdrains.

At the crossing of Scott Creek, the State has built a reinforced concrete bridge. This structure is placed on 50 precast concrete piles and a total of 1012 cubic yards of concrete were used in its construction and that of box culverts, headwalls and other minor structures. A total of 154,200 pounds of bar reinforcing steel was required.

To prevent scour and washing around the footings of the Scott Creek bridge nearly 5000 cubic yards of heavy rock rip rap was placed.

It is estimated the improvement will cost approximately \$296,030. Financing was made partially possible by the contribution of \$150,000 by Joint Highway District No. 9, formed in 1928 by Santa Cruz, San Mateo and San Francisco counties. The remainder was provided from the State highway fund, 58 per cent from federal apportionments for Federal Aid secondary roads and 42 per cent from State money.

N. M. Ball Sons of Berkeley were the contractors on the work and the Resident Engineer for the State was H. A. Simard.

"Hey, what's the big idea, painting your ear red on one side and blue on the other?"

"It's a great idea. You should hear the witnesses contradicting each other."

Traffic on State Highways Shows Increase of 9.1 per cent over 1938

By C. H. PURCELL, State Highway Engineer

THE annual state-wide traffic count on State highways for the current year was taken on Sunday and Monday, July 16 and 17, at approximately 1300 stations throughout the State and reveals an increase of approximately 9 per cent over the corresponding period in 1938.

This marks a definite change in the trend which has been noted since 1935 wherein the annual summer counts, while showing increases over previous years, nevertheless indicated that the rate of increase was steadily declining. The Division of Highways was greatly concerned over the trend and the consequent decrease in gasoline consumption. The traffic count of 1938 showed a less than one per cent increase over that of 1937.

UPTURN IN JULY

From our records it appears that the marked upturn in traffic began last June and further accelerated in July. Comparing the number of out-of-State cars recorded during the annual July counts in 1938 and 1939, we discovered that this type of traffic, due in some measure to the San Francisco Exposition, has increased approximately 80 per cent over last year.

This increase accounted for approximately 3.4 per cent of the over-all increase of 9.1 per cent, which still leaves us with an intrastate traffic which is approximately a 6 per cent increase over that of 1938, when traffic had flattened out to a point where it remained almost at a standstill with the traffic of 1937.

The count this year showed a total of 11,548,024 vehicles passing the 1300 stations as compared with 10,442,659 vehicles for the Sunday and Monday count of July, 1938, an increase of approximately 9.1 per cent.

The count of out-of-State cars on these same dates this year showed a total of 742,702 as against 422,023 in the 1938 count, an increase of about 80 per cent.

It is a source of satisfaction to us that a comparison of the seven months' period, January to July, 1939, with the same period in 1938, based on monthly counts which show an increase of 4.7 per cent in traffic on State highways, is substantiated by the fact that a similar comparison for the same periods of monthly gasoline tax sales for the entire State, as reported by the Board of Equalization, shows an increase of 4.5 per cent.

Increases were quite similar for both Sunday and Monday in the 1939 count; and while there was some variation in the rate all route groups participated in the general increase.

The State total is very naturally greatly influenced by whatever record is set by the main north and south routes. It is to be noted that all of these show a marked increase, the smallest percentage being on Route 4, U. S. 99 between Los Angeles and Sacramento, a circumstance readily accounted for by the fact that this route recorded a notable increase over the previous year in July, 1938, when most of the other main routes were showing only very moderate gains or even losses.

LOSSES ON MINOR ROUTES

The number of routes showing losses either in Sunday or Monday traffic is very much smaller than during the 1938 count, and in most instances these were comparatively minor routes and the losses were moderate or merely nominal.

The regular procedure of previous years was again followed in taking this year's count. Actual recording covers the 16-hour period from 6 a.m. to 10 p.m. for both Sunday and Monday. Traffic was segregated by hourly periods into the following vehicle classifications:

California passenger cars, out-of-state passenger cars, buses, light trucks, heavy trucks, trailers drawn by trucks, trailer coaches, and other passenger-car trailers.

Each year some minor changes in the census become necessary, such as the relocation, addition, or discontinuance of individual stations; but in every instance these are excluded when determining comparisons with the previous year, only those stations that were identical during both years being taken into consideration.

These comparisons for the various route groups are as follows:

PER CENT GAIN OR LOSS FOR 1939 COUNT AS COMPARED WITH 1938

	Sunday	Monday
All Routes	+ 9.64	+ 8.86
Main North and South Routes.....	+13.30	+11.43
Interstate Connections.....	+ 2.79	+ 1.75
Laterals Between Inland and Coast.....	+ 6.19	+ 5.92
Recreational Routes	+ 9.81	+11.68

The gain or loss of traffic volume for State Highway Routes 1 to 80 inclusive, which constitute the basis for the foregoing summary, is shown in the following tabulation:

Route	Termini	1939 Per cent, gain or loss			
		Sunday	Monday	Sunday	Monday
1.	Sausalito-Oregon Line	21.18	21.05		
2.	Mexico Line-San Francisco.....	13.85	12.62		
3.	Sacramento-Oregon Line	8.54	13.83		
4.	Los Angeles-Sacramento.....	5.46	3.33		
5.	Santa Cruz Jc. Rt. 65 near Mokelumne Hill.....	11.22	8.86		
6.	Napa-Sacramento via Winters.....	20.65	17.86		
7.	Crockett-Red Bluff	21.51	16.93		
8.	Ignacio-Cordelia via Napa.....	2.73	2.56		
9.	Rt. 2 near Montalva-San Bernardino.....	2.12	0.86		
10.	Rt. 2 at San Lucas-Sequoia National Park	1.80	4.99		
11.	Rt. 75 near Antioch-Nevada Line via Placerville.....	3.55	2.95		
12.	San Diego-El Centro	1.18	3.29		
13.	Rt. 4 at Salida-Rt. 23 at Sonora Jc.....	7.93	14.31		
14.	Albany-Martinez	22.12	22.93		
15.	Rt. 1 near Calpella-Rt. 37 near Cisco	7.15	0.97		
16.	Hopland-Lakeport	1.20	5.81		
17.	Rt. 3 at Roseville-Rt. 15, Nevada City	11.64	4.87		
18.	Rt. 4 at Merced-Rt. 40 near Yosemite	10.41	7.96		
19.	Rt. 2 at Fullerton-Rt. 26 at Beaumont	7.45	4.87		
20.	Rt. 1 near Arcata-Rt. 83 at Park Boundary	6.06	4.28		
21.	Rt. 3 near Richvale-Rt. 29 near Chilcoat via Quincy.....	1.12	3.68		
22.	Rt. 56, Castroville-Rt. 29 via Hollister	29.07	11.01		
23.	Rt. 4 at Tunnel Sta.-Rt. 11, Alpine Jc.....	8.22	11.09		
24.	Rt. 4 near Lodi-Nevada State Line	9.85	10.38		
25.	Rt. 37 at Colfax-Rt. 83 near Sattley	8.18	5.21		
26.	Los Angeles-Mexico via San Bernardino	2.40	0.48		
27.	El Centro-Yuma	17.87	17.86		
28.	Redding-Nevada Line via Alturas	21.52	31.42		

Route	Termini	1939			
		Per cent, gain or loss Sunday		Monday	
		Gain	Loss	Gain	Loss
29. Peanut-Nevada Line near Purdy's		11.00			8.86
31. Colton-Nevada State Line		1.19	2.77		
32. Rt. 56, Watsonville-Rt. 4 near Califa		16.98			0.52
33. Rt. 56 near Cambria-Rt. 4 near Famoso		5.42			3.04
34. Rt. 4 at Galt-Rt. 23 at Pickett's Jc.		28.73		16.23	
35. Rt. 1 at Alton-Rt. 20 at Oouglas City		2.25		13.90	
37. Auburn-Truckee		24.23		23.72	
38. Rt. 11 at Mays-Nevada Line via Truckee River		18.71		16.78	
39. Rt. 38 at Tahoe City-Nevada State Line		4.64	5.23		
40. Rt. 13 near Montezuma-Rt. 76 at Benton		35.00		51.50	
41. Rt. 5 near Tracy-Kings River Canyon via Fresno		4.16		4.81	
42. Redwood Park-Los Gatos		1.00		7.00	
43. Rt. 60 at Newport Beach-Rt. 31 near Victorville		9.72		5.13	
44. Boulder Creek-Redwood Park		14.87		6.27	
45. Rt. 7, Willows-Rt. 3 near Biggs		5.05		1.38	
46. Rt. 1 near Klamath-Rt. 3 near Cray		No change		11.91	
47. Rt. 7, Orland-Rt. 29 near Morgan		0.88	6.44		
48. Rt. 1 N. of Cloverdale-Rt. 56 near Albion		64.27		31.09	
49. Napa-Rt. 15 near Sweet Hollow Summit		0.37		2.60	
50. Sacramento-Rt. 15 near Wilbur Springs		8.44		1.74	
51. Rt. 8 at Schellville-Sebastopol		22.85		11.06	
52. Alto-Tiburon		4.47		29.50	
53. Rt. 7 at Fairfield-Rt. 4 at Lodi via Rio Vista		9.30		2.91	
54. Rt. 11 at Perkins-Rt. 65 at Central House		5.05	7.43		
55. Rt. 5 near Glenwood-San Francisco		21.97		8.74	
56. Rt. 2 at Las Cruces-Rt. 1 Fernbridge		13.81		16.36	
57. Rt. 2 near Santa Maria-Rt. 23 near Freeman via Bakersfield		8.04		0.44	
58. Rt. 2 near Santa Margarita-Arizona Line near Topock Mohave and Barstow		9.41	1.80		
59. Rt. 4 at Gorman-Rt. 43 at Lake Arrowhead		15.59		2.23	
60. Rt. 2 at Serra-Rt. 2 at El Rio		16.25		18.29	
61. Rt. 4 S. of Glendale-Rt. 59 near Phelan		3.07	3.12		
62. Rt. 171 at Northam-Rt. 61 near Crystal Lake		0.45		8.12	
63. Big Pine-Nevada State Line		25.29		9.86	
64. Rt. 2 at San Juan Capistrano-Blythe		7.67		2.10	
65. Rt. 18 near Mariposa-Auburn		1.69		1.77	
66. Rt. 5 near Mossdale-Rt. 13 near Oakdale		8.31		16.67	
67. Pajaro River-Rt. 2 near San Benito River Bridge		6.89		14.69	
68. San Jose-San Francisco		16.39		12.04	
69. Rt. 5 at Warm Springs-Rt. 1, San Rafael		9.91		16.11	
70. Ukiah-Talmage		28.03		9.69	
71. Crescent City-Oregon Line		28.39		20.35	
72. Weed-Oregon Line		41.61		7.58	
73. Rt. 29 near Johnstonville-Oregon Line		2.84		10.25	
74. Napa Wye-Cordelia via Vallejo and Benicia		0.43		6.63	
75. Oakland-Jc. Rt. 65 at Altaville		1.67		10.71	
76. Rt. 125 at Shaw Ave.-Nevada State Line near Benton		9.82		21.92	
77. San Diego-Los Angeles via Pomona		6.41		13.73	
78. Rt. 12 near Descanso-Rt. 19 near March Field		6.89		9.81	
79. Rt. 2, Ventura-Rt. 4 at Castaic		0.76	10.55		
80. Rt. 51, Rincon Creek-Rt. 2 near Zaca		4.35	5.55		



Approaches to bridge washed away by desert torrents on U. S. 60.

\$500,000 Damage to Desert Highways in South by Rains

(Continued from page 5)

of September 25th, bringing the total rainfall in Coachella Valley to approximately 11 inches for the storm period during September.

The September 25th storm also covered practically the entire northerly end of the Colorado Desert, gathering considerable intensity along the Colorado River, where all of the repair work which had been done on U. S. Highway 95 was destroyed and considerable additional damage occurred.

Traffic is now routed through on all of the highways but it will not be possible to complete all of the repairs on the storm damaged highways for several weeks.

The estimated cost of placing the damaged highways in condition to again carry traffic, without any improvement or additional protection, is approximately \$120,000.

The ditch and dyke system on that portion of the highway west of Blythe was one of the earlier constructed systems on which the ditches and levees are somewhat too flat and bridges too far apart and inadequate to carry any such storm as has just occurred. It is hoped that some Federal assistance may be secured which may permit more adequate protection work, enlargement of structures and

Communities Must Organize to Receive Water and Power

(Continued from page 5)

become consumers and are directly interested in obtaining water and power at the lowest possible cost.

Business generally also has a vital interest in the creation of these outlets so water and power will be available to the greatest number of users at the lowest possible cost. Money saved on irrigation and power bills will be spent on farm machinery, industrial expansion, household furnishings and a higher living standard.

For this reason, if none other, the disposition of water and power from the Central Valley Project is of prime importance to every business-man in the state.

Governor Culbert L. Olson has pledged himself and his administration to the assurance of means for public ownership and operation of plants and distributive facilities through which this water and power may be obtained at cost.

With the backing of those who are to benefit by this program—agriculture, industry, municipalities and business—he can and will fulfill this pledge to the people of California.

"I'm in a terrible spot. My wife doesn't know anything but one-syllable words."

"Mmm. That's almost unbelievable for a wife."

"Why?"

"'Money' has two syllables."



Scenic view on new "Industrial Highway" across Diablo Valley in Contra Costa County showing Mount Diablo in background.

First Unit of 'Industrial Highway'

TAPPING the cities of Martinez, Pittsburg, Antioch and other centers along deep water, the first unit of the Industrial Highway in Contra Costa County which ultimately will provide for smooth traffic flow from the rich farm lands of the San Joaquin Valley was completed by the Division of Highways last month. The new route entailed construction

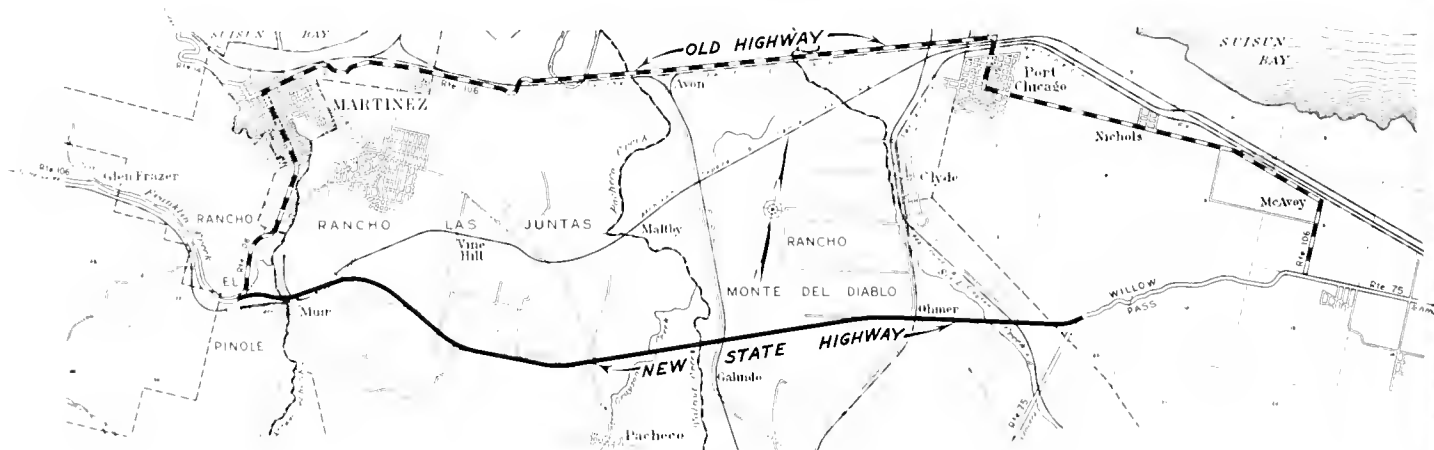
on a direct alignment from the easterly end of Franklin Canyon at Muir Station across the lower end of the Diablo Valley to a connection with the Concord-Pittsburg highway near the westerly end of Willow Pass. The next projected improvement will be reconstruction on modern standards of the route through Willow Pass.

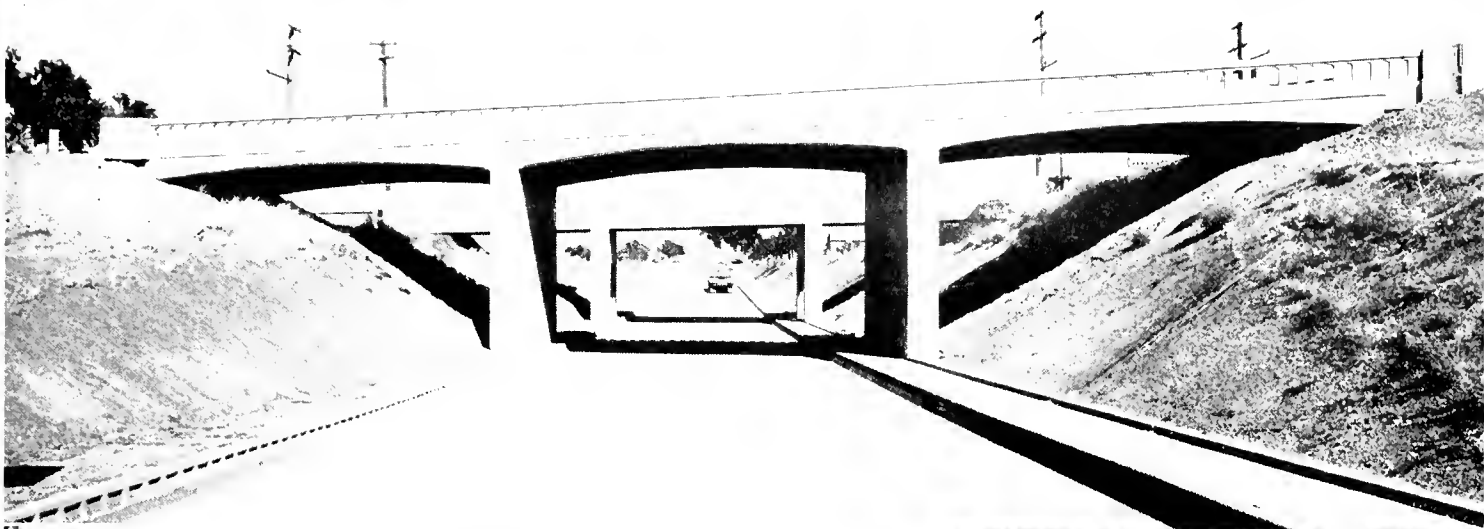
The recently completed stretch of

roadway is eight miles in length and constitutes a two-lane highway paved 22 feet wide with heavy plant-mixed surfacing. Each traffic lane is 11 feet in width to conform to latest standards of the Division of Highways. Adequate bituminous treated shoulders are on both sides of the pavement.

Plans for future development of

(Continued on page 28)





At top—Section of new 22-foot "Industrial Highway" between Willow Pass and Franklin Canyon in Contra Costa County. Center—Grade separation structures carrying county road and railway. Bottom—View looking westerly through deep cut near east end of Willow Pass.

Evolution of the Striping Machine

WITH the growing importance of properly striping thousands of miles of California State highways, the engineering staff of Headquarters Shop of the Division of Highways in Sacramento is constantly striving to improve the traffic stripe marking machines used by the Division.

A new stripe marking outfit has been turned out at the shops for use in District III. While it is substantially the same in design as the machine now operated by the Division, a number of changes in construction have been made.

It was found advisable to increase the carrying capacity of the truck used with the stripe marking units to allow the hauling of a larger supply of paint. Also, on the larger trucks with the conventional type cab, the truck hood interfered with the truck driver's view of the marking machine and its operator. On the new machine the cab-over-engine type of truck is used. This affords a much wider range of vision for the truck driver and makes it possible to secure sufficient floor space on the truck body with the use of a comparatively short wheel base truck.

MORE PAINT CAPACITY

The new units are equipped with an additional paint tank for carrying yellow paint for use on double-line work. The valves and fittings have been rearranged for convenience in handling.

On the late type divided highways it was decided to place a white line next to the dividing curb or center strip, and it was necessary to improvise some means of doing this. It was not feasible to straddle the desired position of the white line, as the center strip on most of these roads is not finished, and it would be impossible to put down a straight line. The shops therefore devised an outrigger attachment for these machines, permitting the striping assembly to be set far enough out to clear the wheels of the propelling truck. When this is done it is necessary to put down an offset guide line, or pilot stripe, and the truck and marking machine follow this offset line.



1



2



3



4



5

By R. H. STALNAKER
Equipment Engineer

It is a far cry from the striping machine created in the early 20's by engineers of District IV to the improved outfit now being produced at the Division of Highways Shop. This first machine was pushed by hand, the paint being deposited in a reservoir attached to the frame and flowing by gravity through a rubber tubing to the pavement immediately ahead of a paint brush which spread the paint on the road. (See Photo No. 1 on this page.)

In the late 20's, the hand-powered machine followed. (Photo No. 2.)

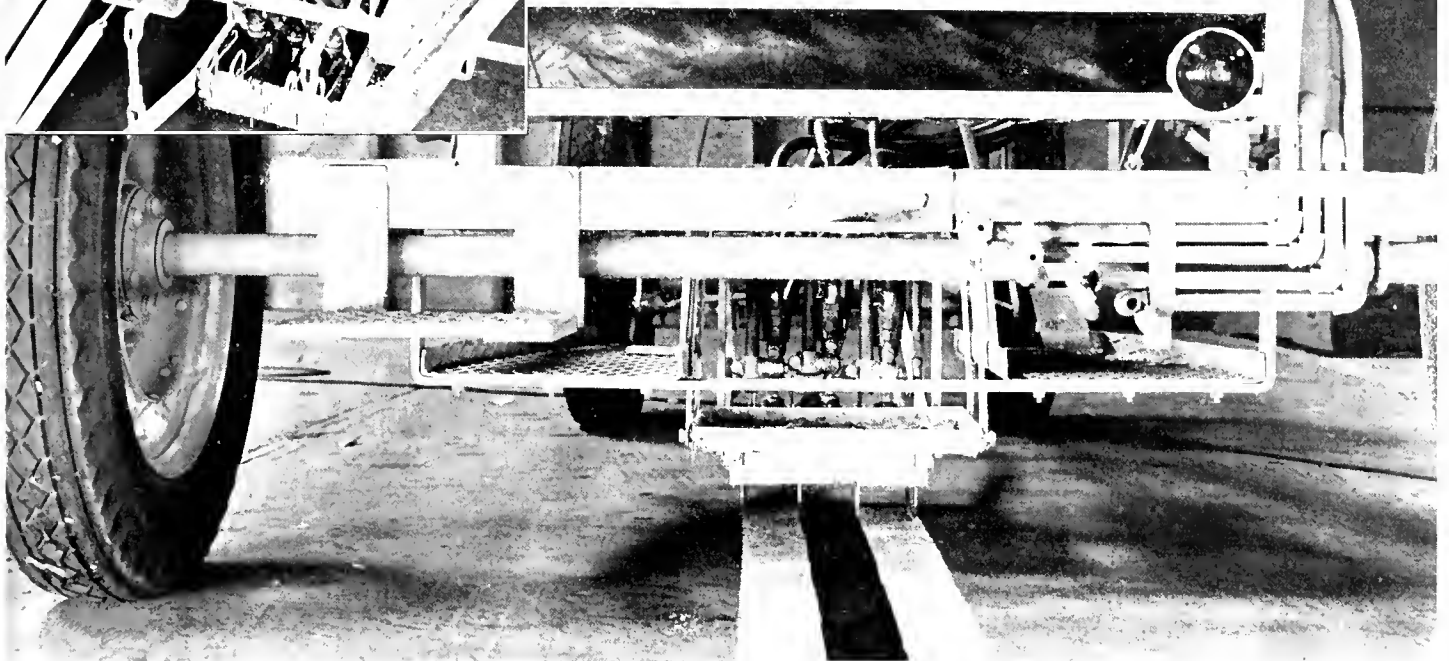
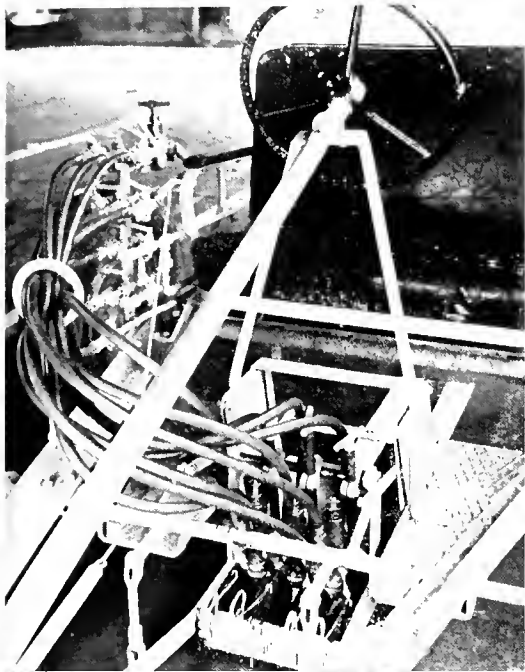
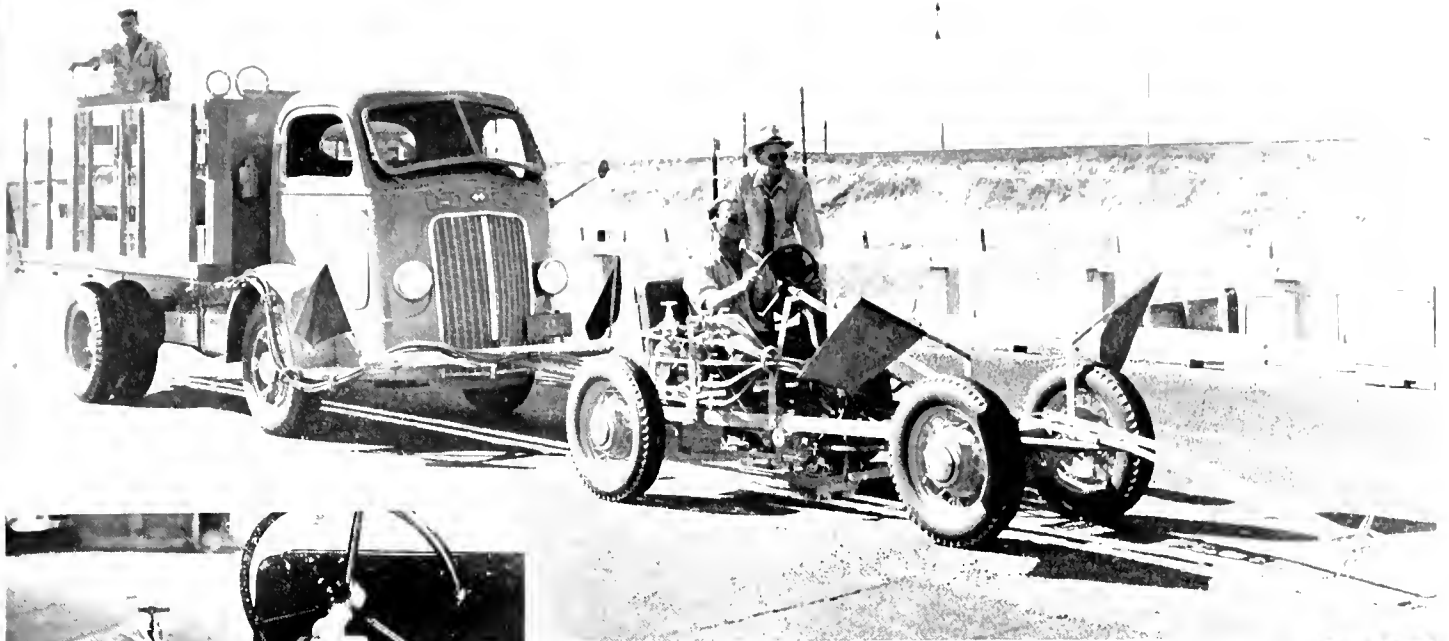
SAT ON THE BUMPER

The first unit on which the paint supply and compressor were mounted on a truck was used in the early 30's. A seat for the operator was arranged on the bumper of the truck and the marking machine was propelled by a push bar from the truck. (Photo No. 3.)

Next came the chassis type marker which provided a seat for the operator and was constructed with a longer wheel base which only painted a single 4-inch line. On this unit also the paint supply tank and air compressor were mounted on the truck propelling the unit. This machine was used until about 1937. (Photo No. 4.)

In 1937 District IV designed a machine which laid the three-stripe centerline on pavements in one operation. The paint and air controls were mounted on the chassis of the striper, which was propelled ahead of the truck by a push bar. The truck also carried the air compressor unit and mixing tank equipped with an agitator where the paint was prepared for filling the supply tanks. The supply tanks were filled by pumping the paint from the mixing tank. (Photo No. 5.)

This is the type of machine on which improvements have been made by Headquarters Shop.



At top—Complete striping outfit in operation restriping triple line. Man on truck mixing paint with hand agitator. Center—Close-up showing paint and air lines to each spray gun and controls. Bottom—Rear view of striping unit laying triple stripe.

Legislation of 1939 Session Affecting State Highways

(Continued from page 13)

partments to endorse warrants issued by the controller when for some reason the claimant should not receive the warrant directly, as, for example, when the claim has previously been paid through a revolving fund.

CHAPTER 961. Provides for the proration among the various special funds in the State treasury of the cost of administering the civil service laws. The State highway fund will bear its proportion.

CHAPTER 595. Makes it easier from an accounting standpoint to handle work for counties on a co-operative basis.

The acquisition of rights of way needed for State highways is, year by year, assuming greater importance. It becomes a major consideration whenever one of the new type highways above mentioned is contemplated. The legislature, realizing this situation, granted additional authority to the Department of Public Works in connection with right of way matters.

CHAPTER 686. Considerably broadens the scope of the activities of the department in connection with the acquisition of rights of way. The authority to acquire for future needs is expressly given. The leasing out of property acquired for future needs so that revenue can be obtained therefrom is authorized. Full authority is granted to acquire all rights of way needed for free-ways.

CHAPTER 292. Authorizes the conveyance of property controlled for highway purposes to the federal government for inclusion in national parks. This chapter also authorizes agreements with the federal government concerning State highways passing through national monuments.

CHAPTERS 146 AND 147. Authorize the City of Oakland to convey certain tidelands back to the State for State highway purposes.

CHAPTER 86 OF RESOLUTIONS. Addressed to Congress, it asks for a receding of jurisdiction over the area required for the Funston Avenue approach to the Golden Gate

Bridge through the Presidio in San Francisco.

Basically highways are built for the use of traffic, and while the Division of Highways is not primarily concerned with the enforcement of traffic laws, it is concerned with the provisions of those laws as they must be taken into consideration in determining the type of highway that should be built. Due to the fact that the responsibility for placing and maintaining all official traffic signs and signals, including directional and warning signs, is assigned to the Division of Highways, legislation affecting these matters is of particular interest.

Several years ago there was established within the Division of Highways a Safety Department designed to coordinate the actual construction and maintenance work with the efforts of traffic enforcement agencies and accident prevention activities. This department makes intensive studies of all accidents occurring on the State highway system to determine whether a different method of construction is necessary or whether the fault lies in the traffic laws or regulations applicable to the particular highway. Many of the changes made in the vehicle laws were due to the suggestions or approval of the Division of Highways acting through the Maintenance Department and the Safety Department.

CHAPTER 311—Makes it clear that all accident reports received by the Department of Motor Vehicles under the Vehicle Code are open to the confidential use of the Department of Public Works. While the department in the past has received the utmost cooperation in this connection from the Department of Motor Vehicles, there has been some doubt as to the legality of the procedure followed, due to the provisions of law to the effect that accident reports were for the confidential use of the Department of Motor Vehicles. This enactment removes all such doubts.

As above mentioned, Chapter 684 writes into law the prohibition against crossing the double line now in use on State highways.

CHAPTER 658. Abolishes the 20-mile speed limit zone, making the 25-mile speed limit applicable in all of the former 20-mile zones. This chapter also will eliminate many of the unnecessary restricted speed zones. It also authorizes traffic signals in cities to be timed so that some variance from the 25-mile prima facie speed limit will be permitted. Permissive speed of trucks is raised in some instances.

CHAPTER 320. Regulates the use of certain colors in traffic signals so that the use of these colors will have a uniform meaning throughout the State. This chapter also clarifies the provisions of the Vehicle Code so as to more clearly indicate the position at which a stop must be made at "STOP" intersections.

CHAPTER 188. Authorizes the placing and maintenance of "Cattle Crossing" and "Open Range" signs.

CHAPTER 788. Among other things, abolishes as of December 31, 1942, certain preferences given to some of the older trucks in so far as width and permissive weight are concerned. The permissive length of single vehicles is increased to 35 feet. The department is authorized to issue permits for the use of booster trucks in the event such units are considered safe for operation in specific locations.

CHAPTER 653. Recognizes a new type of vehicle consisting of a semi-trailer with a dolly attachment and prescribes weight limitations and registration fees for such vehicles.

General requirements as to lamps and brakes on all vehicles are changed.

CHAPTER 248. Makes a minor change in the present provision prohibiting angle parking on State highways within business districts.

CHAPTER 612. Gives the department full authority to regulate parking on State highways in areas where snow removal operations are necessary. In some snow sports areas considerable confusion has resulted in the past because no regulation of parking could be enforced.



Learns of Stupendous Task

San Francisco

Editor California Highways
and Public Works
Sacramento, California

Dear Sir:

Please let me congratulate you on putting out such an interesting and informative little magazine. I have been reading it for the past year and enjoy it very much.

There is no doubt but what a knowledge of the stupendous task of building modern highways makes one more appreciative of the fine public roads we of California have. I never realized what a scientific problem a highway was until I started reading your little journal.

Thank you very much.

CARL I. NELSON.

Doing Great Job

Editor California Highways
and Public Works
Sacramento, California

Dear Sir:

A recent issue of the above-named publication just came into my hands and after partly perusing same I think it is just what I and every red-blooded Californian needs to keep us reminded that we have a great State and that the Department of Public Works, Division of Highways is doing a big job.

Having been born in Woodland, just over your shoulder and my father having been one of Fremont's men in 1846, when he and others acquired this glorious domain, I think your placing me on your mailing list will about fill out my desires.

Sincerely yours,

WM. T. W. CURL.

"Best Highway Magazine"

Federal Works Agency
Work Projects Administration in Ohio
127 Brevoort Road
Columbus, Ohio
August 25, 1939

California Highway and Public Works
Sacramento, Calif.
Gentlemen:

Have been recently located in Washington, D. C., and do not recall whether your magazines sent there to me or forwarded from Columbus. Have been transferred to Columbus and will be at above address until further notice.

Your magazine is by far the best highway magazine published by any state in the union and I only hope the time will come when we can publish as good a magazine here in Ohio. Thanking you for courtesies extended in the past.

Very truly,

HARRY T. FLASHER,
Engineer Highway Dept.,
127 Brevoort Rd.,
Columbus, Ohio.

Educational Reading

Los Angeles, California

Editor California Highways
and Public Works
Sacramento, California

Gentlemen:

It has indeed been a pleasure to read some borrowed issues of the California Highways and Public Works magazine. I think them extremely instructive and educational and know they would be very helpful in my present position.

Will you kindly place my name on your mailing list.

Thanking you in advance, I am

Cordially yours,

VICTOR L. WESLEY,
Los Angeles, Calif.

Request from Honolulu

Territory of Hawaii, Honolulu
August 17, 1939.

Editor California Highways
and Public Works
Sacramento, California

Dear Sir:

Will you please put my name on the mailing list for your publication "California Highways and Public Works." I have seen copies of this publication in the office of the Public Roads Administration here in Honolulu and find it to be very interesting and instructive.

Very truly yours,

J. C. MYATT,
Highway Engineer.

COMPTON JUNIOR COLLEGE

Compton, California

Editor,
California Highways and Public Works,
Sacramento, California.

Dear Sir:

Through the courtesy of our local Chamber of Commerce, I have made occasional

use during the course of the past school year of your official journal "California Highways and Public Works"; having found it to be of service in connection with the work of our social studies classes in this institution.

If possible, I should appreciate having my name placed on your mailing list to receive a copy of this publication for use in our classes. I consider it of sufficient value to desire a regular file of all issues.

Cordially yours,

Signed:

ROBERT C. GILLINGHAM,
Chairman, Social Studies.

Library Values It

Colton Public Library
Colton, California

John W. Howe, Editor
California Highways and Public Works
Sacramento, California

Dear Sir:

The patrons of Colton Public Library value the magazine "California Highways and Public Works" very highly and we find the material contained therein is the answer to many questions that arise.

We should like to have a second copy if it is available as that would allow us one for binding and one for circulation. Thanking you for your courtesy.

Very truly yours,

MRS. ANNA E. SPRAGINS,
Librarian.

Appreciation from Navy

Editor California Highways
and Public Works,
Sacramento, California.

Dear Sir:

Permit me to express my appreciation for receiving "California Highways and Public Works" and to congratulate you on its general excellence. I have been receiving it for about four years and find the design and construction features of improvements and relocations of particular interest. The character of your publication is in keeping with the fine highways of California.

Very truly yours,

C. C. SEABURY,
Lt. (CEC), U. S. N.,
Bureau of Yards and Docks,
Navy Department,
Washington, D. C.

Highway Bids and Awards for the Month of September, 1939

ALAMEDA COUNTY—Between 1.2 and 8.3 miles east of Mission San Jose, about 1.8 miles, surface with crusher-run base and armor coat. District IV, Route 108, Section A. Independent Construction Co., Ltd., Oakland, \$12,679; A. A. Tieslan, Berkeley, \$12,816; Pacific Truck Service, Inc., San Jose, \$12,987; Lee J. Immel, Berkeley, \$13,361; A. J. Clausen, Berkeley, \$13,470. Contract awarded to Jones & King, Hayward, \$12,311.50.

AMADOR, CALAVERAS AND TUOLUMNE COUNTIES—Between Amador City and Long Barn, about 23.6 miles seal coat to be applied. District X, Routes 65 and 13, Sections BC, ABC, A, CD. Lee J. Immel, Berkeley, \$14,828; Oranges Bros. Construction Dept., Stockton, \$14,715; Granite Construction Co., Ltd., Watsonville, \$13,897. Contract awarded to Close Building Supply, Hayward, \$12,972.

AMADOR COUNTY—At Jackson Creek, about 1.4 miles to be graded. District X, Route 97, Section A. Poulos & McEwen, Sacramento, \$17,071; Anderson & France, Visalia, \$17,138; Louis Biasotti & Son, Stockton, \$18,128; M. J. B. Construction Co., Stockton, \$19,339; Hemstreet & Bell, Marysville, \$19,787; Harms Bros., Sacramento, \$20,360; Shea & Beebe, Los Angeles, \$21,312; Claude C. Wood, Lodi, \$23,645; A. Teichert & Son, Inc., Sacramento, \$24,947. Contract awarded to Parish Bros., Los Angeles, \$16,662.

BUTTE COUNTY—Between 0.4 mile south of Fagan and Biggs Road, about 5.9 miles to be graded and surfaced with plant-mix surfacing. District III, Route 3, Sections A, Grd., B. Poulos & McEwen, Sacramento, \$73,306; Hemstreet & Bell, Marysville, \$71,909; Independent Construction Co., Ltd., Oakland, \$76,755; A. Teichert & Son, Inc., Sacramento, \$78,821; Marshall Hanrahan, Redwood City, \$79,292. Contract awarded to Piazza and Huntley, San Jose, \$68,349.

CALAVERAS COUNTY—Between 1.7 and 2.5 miles east of Valley Springs, about 0.8 mile to be graded and surfaced with imported gravel. District X, Route 24, Section B. Hemstreet & Bell, Marysville, \$19,687; Caputo & Keeble, San Jose, \$19,881; Harms Bros., Sacramento, \$21,321; Fredrickson Bros., Emeryville, \$22,516; Marshall Hanrahan, Redwood City, \$23,126; M. J. B. Construction, Stockton, \$23,845; Parish Bros., Los Angeles, \$24,041; Oranges Bros. Construction Dept., Stockton, \$26,313. Contract awarded to Claude C. Wood, Lodi, \$19,531.80.

CONTRA COSTA COUNTY—Between Broadway Tunnel and Concord and between 3.0 and 1.5 miles north of Byron, about 12.6 miles, crusher run borders to be constructed and retrod surfacing and non-skid surface treatment to be applied. District IV, Route 75, Sections A, B, D. Heafey-Moore Co., Oakland, \$28,569. Contract awarded to Lee J. Immel, Berkeley, \$32,062.

FRESNO COUNTY—Between Kings River Bridge and Deer Cove Creek, about 6.5 miles, road-mix surface treatment to be applied. District VI, Route 41, Sections E, F. Basich Bros., Torrance, \$10,735; Oilfields Trucking Co., Bakersfield, \$10,867. Contract awarded to Ruddy & Cortfield, Modesto, \$9,860.

GLENN AND BUTTE COUNTIES—Between 1 mile east of Butte City and Cherokee Canal, about 11.8 miles, roadbed to be shaped and surfaced with gravel base. Dis-

trict III, Route 45, Sections C, A. Louis Biasotti & Son, Stockton, \$48,990; Fredrickson & Westbrook, Sacramento, \$49,922; Heafey-Moore Co.-Fredrickson & Watson Construction Co., Oakland, \$56,550; Harms Bros., Sacramento, \$57,425; A. Teichert & Son, Inc., Sacramento, \$59,176; Poulos & McEwen, Sacramento, \$59,625; Hemstreet & Bell, Marysville, \$66,325; Marshall Hanrahan, Redwood City, \$66,655. Contract awarded to N. M. Ball Sons, Berkeley, \$44,291.25.

HUMBOLDT COUNTY—Across Elk Creek, about 19 miles north of Garberville, a reinforced slab bridge to be constructed and about 0.25 mile of approach to be graded and finished. District I, Route 1, Section C. A. A. Tieslan, Berkeley, \$27,146; Scheumann and Johnson, Eureka, \$33,245. Contract awarded to E. E. Smith, Eureka, \$23,797.80.

KERN COUNTY—Between Rosamond and Mojave, about 7.8 miles to be graded and surfaced with plant-mix surfacing. District IX, Route 23, Section A. Basich Bros., Torrance, \$64,120; Claude C. Wood, Lodi, \$65,347; Griffith Co., Los Angeles, \$68,013; G. W. Ellis, North Hollywood, \$69,897; Fredrickson & Westbrook, Sacramento, \$71,832; Jones & King, Hayward, \$73,599; United Concrete Pipe Corporation, Los Angeles, \$81,910; Oswald Bros., Los Angeles, \$83,741; A. S. Vinnell Co., Alhambra, \$88,741. Contract awarded to R. E. Hazard & Sons, San Diego, \$62,672.50.

LOS ANGELES COUNTY—Between Placerita Canyon and Solamint, about 3.4 miles to be graded and surfaced with plant-mix surfacing. District VII, Route 23, Section I. Griffith Co., Los Angeles, \$226,009; Fredrickson & Westbrook, Sacramento, \$227,465; J. E. Haddock, Ltd., Pasadena, \$241,744; Claude Fisher Co., Ltd., Los Angeles, \$244,054; Clarence Crow, Los Angeles, \$245,263; Radich & Brown, Burbank, \$253,551; Eaton & Smith, San Francisco, \$254,341; United Concrete Pipe Corp., Los Angeles, \$255,482; Daley Corp., San Diego, \$259,767; Maceo Construction Co., Clearwater, \$259,916; Clyde W. Wood, Los Angeles, \$261,168; Utah Construction Co., San Francisco, \$272,416; Basich Bros., Torrance, \$272,496; W. E. Hall Co., Alhambra, \$273,048; Oswald Bros., Los Angeles, \$273,824; Gibbons & Reed Co., Burbank, \$317,776. Contract awarded to N. M. Ball Sons, Berkeley, \$222,596.50.

LOS ANGELES COUNTY—Across Arroyo Seco Parkway at Avenue 26, a reinforced concrete bridge to be constructed as an extension to an existing bridge and the northerly approach thereto reconstructed. District VII, Route 205, Section L. A. Oberg Bros., Los Angeles, \$45,162; United Concrete Pipe Corp., Los Angeles, \$49,873; Byerts & Dunn, Los Angeles, \$52,698. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$43,236.20.

MARIPOSA COUNTY—Between Cathay and Briceburg, about 7.4 miles, seal coat to be applied. District X, Route 18, Sections D, E, I, J. H. Sykes, Patterson, \$8,235. Contract awarded to Hayward Building Material Co., Hayward, \$6,408.

MENDOCINO COUNTY—Across Russian River, about 1 mile east of Hopland, a bridge consisting of 3 main steel girder spans, one at 108 feet and 2 at 84 feet, with seven 38-foot and two 29-foot steel stringer approach spans to be constructed

and about 0.3 mile to be graded and surfaced with plant mix surfacing and Class "C" seal coat. District I, Route 16, Section A. C. W. Caletti & Co., San Rafael, \$98,652; Union Paving Co., San Francisco, \$98,822; R. G. Clifford, San Francisco, \$107,017; E. E. Smith, Eureka, \$108,181; A. Soda & Son, Oakland, \$108,587; A. G. Raisch, San Francisco, \$109,394; Paul J. Tyler, Oroville, \$112,567; Joseph Shaw, Deer Creek Lodge, \$114,266; Campbell Construction Co., Sacramento, \$116,552; John Rocca, San Rafael, \$122,220; Fred J. Maurer & Son, Eureka, \$122,589. Contract awarded to Trewitt-Shields & Fisher, Fresno, \$97,389.20.

MENDOCINO COUNTY—At Russian Gulch, about 9 miles south of Fort Bragg, a reinforced concrete bridge consisting of 29 slab spans having a total length of 526 feet 9 inches supported on an open spandrel arch and concrete bents to be constructed and about 0.6 mile of approaches to be graded and a Class "C" seal coat applied thereto. District I, Route 56, Section E. John Rocca, San Rafael, \$108,318; Joseph Shaw, Mill Creek, \$109,735; Poulos & McEwen & M. A. Jenkins, Sacramento, \$113,834; Paul J. Tyler, Oroville, \$118,958; Fred J. Maurer & Son, Eureka, \$120,141; E. E. Smith, Eureka, \$122,735; C. W. Caletti & Co., San Rafael, \$124,107; Union Paving Co., San Francisco, \$126,730; United Concrete Pipe Corp., Los Angeles, \$133,618. Contract awarded to R. G. Clifford, San Francisco, \$104,510.60.

MENDOCINO COUNTY—Between Crawford Ranch and Ukiah, about 7 miles to be graded, plant-mix surfacing to be placed on gravel base and a bridge to be constructed. District I, Route 1, Section B. Chas. L. Harney, San Francisco, \$367,878; Heafey-Moore Co.-Fredrickson & Watson Construction Co., Oakland, \$327,112; Hemstreet & Bell, Marysville, \$283,595; The Utah Construction Co., San Francisco, \$329,757; Maceo Construction Co., Clearwater, \$335,513; Marshall Hanrahan, Redwood City, \$289,298; A. Teichert & Son, Inc., Sacramento, \$292,537; United Concrete Pipe Corp. & N. M. Ball Sons, Berkeley, \$316,386; Granfield, Farrar & Carlin, San Francisco, \$334,283; A. G. Raisch, San Francisco, \$346,973; Eaton & Smith, San Francisco, \$351,035. Contract awarded to Fredrickson & Westbrook, Sacramento, \$279,578.80.

MONO COUNTY—Grading and surfacing between 9.1 miles south and Mono Lake and between Route 23 and June Lake. District IX, Routes 23, 111, Sections GH, A. A. S. Vinnell Co., Alhambra, \$16,537. Contract awarded to Basich Bros., Torrance, \$14,555.

MONO COUNTY—At Grant Lake, about 4.0 miles to be graded and imported surfacing material placed on portions. District IX, Route 111, Section A. Parish Bros., Los Angeles, \$39,581; Basich Bros., Torrance, \$55,089; Gibbons & Reed Co., Burbank, \$58,171; A. S. Vinnell Co., Alhambra, \$59,097; Nevada Rock & Sand Co., Inc., Reno, \$59,974. Contract awarded to Shea & Beebe, Los Angeles, \$31,064.50.

MONTEREY COUNTY—On San Juan Road between 2.2 miles and 4.9 miles east of Pajaro, about 2.7 miles to be graded and surfaced with plant-mix surfacing on crusher run base. District V, Feeder road, L. C. Karstedt, Watsonville, \$29,509.10. Contract awarded to Granite Construction Co., Ltd., Watsonville, \$26,398.

MONTEREY COUNTY—Between San Lucas and 1.3 miles south, about 1 mile to

be surfaced with plant-mixed surfacing. District V, Route 2, Section G. Contract awarded to Granite Construction Co., Ltd., Watsonville, \$9,826.

NAPA AND SONOMA COUNTIES—Between Napa County Line and Napa Wye, between Santa Rosa and Beltrane, and between Sears Point and Sonoma County line, about 11.6 miles plant-mixed surfacing seal coat, and retreat surfacing to be placed. District IV, Routes S, 51, 208, Sections A, B, A. A. Chas. L. Harney, San Francisco, \$39,377; A. A. Tieslan, Berkeley, \$33,895. Contract awarded to A. G. Raisch, San Francisco, \$33,467.80.

ORANGE COUNTY In the City of Santa Ana, about 0.25 mile of approaches to Santa Ana River bridge to be graded and paved with portland cement concrete. District VII, Route 174, Griffith Co., Los Angeles, \$22,132; J. E. Haddock, Ltd., Pasadena, \$22,196; W. E. Hall Co., Alhambra, \$28,017. Contract awarded to Vido Kovacevich, South Gate, \$20,404.

RIVERSIDE COUNTY—At Norco, about 1.4 miles to be graded, roadmix surface treatment to be applied, plantmix surfacing to be placed and drainage structures to be constructed. District VIII, Route 193, Section A, Clyde W. Wood, Los Angeles, \$46,008; E. L. Yeager, Riverside, \$46,580; Dinmitt & Taylor, Los Angeles, \$47,429; Oswald Bros., Los Angeles, \$47,768; Griffith Co., Los Angeles, \$48,914; V. R. Dennis Construction Co., San Diego, \$49,876; W. E. Hall Co., Alhambra, \$49,879; A. S. Vinnell Co., Alhambra, \$52,717; J. E. Haddock, Ltd., Pasadena, \$53,258; United Concrete Pipe Corp., Los Angeles, \$53,981; Claude Fisher Co., Los Angeles, \$55,043. Contract awarded to Match Bros., Elsinore, \$44,758.70.

SACRAMENTO COUNTY—Between 1 mile south of Arno and 1½ miles north of Elk Grove, about 5 miles of pit run gravel borders and Class "B" seal coat to be constructed. District III, Route 4, Sections A, B, A. Teichert & Son, Inc., Sacramento, \$10,546; Lee J. Immel, Berkeley, \$10,477; J. R. Reeves, Sacramento, \$12,071. Contract awarded to Hemstreet & Bell, Marysville, \$10,187.

SAN BENITO COUNTY—Across San Benito River, about 1 mile west of Hollister, existing bridge to be redecked. District V, Route 22, Section A, E. W. Peterson, San Francisco, \$9,658; Geo. Renz, Gilroy, \$11,420; Engineers, Ltd., Oakland, \$11,834; Albert H. Siemer & John Carcano, San Anselmo, \$12,055; L. C. Seidel, Oakland, \$12,390. Contract awarded to C. C. Gildersleeve, Berkeley, \$8,998.

SAN JOAQUIN, STANISLAUS AND CALAVERAS COUNTIES—Between Stockton and Altaville, Lodi and 4.5 miles east, about 24 miles, seal coat to be applied. District X, Routes 75 and 24. Close Building Supply, Hayward, \$14,957; Oranges Bros. Construction Dept., Stockton, \$12,552; Elmer J. Warner, Stockton, \$10,630. Contract awarded to A. A. Tieslan, Berkeley, \$10,445.50.

SAN LUIS OBISPO AND SANTA BARBARA COUNTIES—At various locations, about 11.7 miles plant-mixed surfacing and non-skid surfacing to be placed. Frederickson & Westbrook, Sacramento, \$22,089. Contract awarded to Basich Brothers, Torrance, \$20,532.75.

SANTA BARBARA COUNTY—Between Las Cruces and Santa Ynez River, and between Orcutt and Guadalupe, about 4.5 miles to be surfaced with plant-mixed surfacing, road-mix surface treatment, crusher run base, and armor coat. District V, Route 56, Sections A, B, C, E. Frederickson & Westbrook, Sacramento, \$29,091. Contract awarded to Basich Bros., Torrance, \$26,611.

SANTA BARBARA COUNTY—Across Santa Maria River Overflow, about 2 miles north of Santa Maria, existing bridge to be redecked. District V, Route 2, Section A, C. W. Caletti & Co., San Rafael, \$8,546; C. C. Gildersleeve, Berkeley, \$8,827; John Foster, Santa Maria, \$8,875; Theo. Maino, San Luis Obispo, \$10,113; J. S. Metzger & Son, Los Angeles, \$10,109. Contract awarded to Stanley P. Cooley, Palo Alto, \$7,118.47.

SANTA BARBARA COUNTY Between Lompoc and La Salle Road, and between 1st and 2d crossings of Cuyama River, about 3.3 miles to be surfaced with plant-mixed surfacing. District V, Routes 149 and 57, Sections A-A, B. Frederickson & Westbrook, Sacramento, \$21,660. Contract awarded to Basich Bros., Torrance, \$20,470.75.

SANTA CLARA COUNTY—Between Route 5 and Santa Clara Street, about 1.9 miles to be graded and paved with portland cement concrete and asphalt concrete. District IV, Route 68, Section B, S.J.s. Louis Biasotti & Son, Stockton, \$123,167; Jones & King, Hayward, \$124,517; Union Paying Co., San Francisco, \$127,207; Frederickson & Westbrook, Sacramento, \$129,337. Contract awarded to A. J. Raisch & Earl W. Heple, San Jose, \$118,431.60.

SHASTA COUNTY—At Central Valley, about 6.5 miles north of Redding, about 0.5 mile to be graded and surfaced with crusher run base and plant-mix surfacing. District II, Route 3, Section B, A. Teichert & Son, Inc., Sacramento, \$18,660. Contract awarded to Granfield, Farrar & Carlin, San Francisco, \$16,921.90.

SIERRA COUNTY—Between 1.0 mile south of Sierraville and Calpine, about 9.6 miles, penetration oil treatment and road-mix surfacing to be placed. C. F. Frederick & Sons, Lower Lake, \$9,525. Contract awarded to Lee J. Immel, Berkeley, \$7,135.

SOLANO COUNTY—Between 0.6 mile south and 1.0 mile north of Vallejo, about 1.6 miles to be blanketed with imported material and surfaced with plant-mixed surfacing. District X, Route 74, Sections A, D, A. Granzotto & L. Angelus, Walnut Creek, \$25,612; Union Paying Co., San Francisco, \$19,827; Chas. L. Harney, San Francisco, \$22,548; M. J. B. Construction Co., Stockton, \$22,607. Contract awarded to A. G. Raisch, San Francisco, \$17,947.95.

SONOMA COUNTY—At various locations between Jenner and Stewarts Point, about 2.0 miles to be graded, drainage structures and a reinforced concrete bridge to be constructed and penetration oil treatment to be applied. District IV, Route 56, Sections C, D. Parish Bros., Los Angeles, \$99,414; Claude C. Wood, Lodi, \$109,502; Heafey-Moore Co.-Frederickson & Watson Construction Co., Oakland, \$111,001; Louis Biasotti & Son, \$118,012; Piombo Bros. & Co., San Francisco, \$124,851; Chas. L. Harney, San Francisco, \$144,509. Contract awarded to Guerin Bros., San Francisco, \$89,735.90.

TUOLUMNE AND MARIPOSA COUNTIES—Between Mountain Pass and Route 18, and between Moccasin and Coulterville, about 24.9 miles seal coat to be applied. District X, Routes 40, 65, various sections. Pacific Truck Service, Inc., San Jose, \$14,477; Lee J. Immel, Berkeley, \$13,982. Contract awarded to Hayward Building Material Co., Hayward, \$11,163.

VENTURA COUNTY—Across Conejo Creek, about 10 miles south of Moor Park, reinforced concrete slab bridge to be constructed. District VII, Route 155, Section B, Carl Hallin, Los Angeles, \$6,982; Jacobson & Jacobson, Los Angeles, \$7,064; A. S. Vinnell Co., Alhambra, \$7,387; J. E. Haddock, Ltd., Pasadena, \$7,395; Byerts

& Dunn, Los Angeles, \$7,481; C. R. Butterfield Kennedy Co., San Pedro, \$7,499; J. S. Metzger & Son, Los Angeles, \$7,641; Gibbons & Reed Co., Burbank, \$8,285; W. J. Distel, Los Angeles, \$8,368; Geo. J. Bock Co., Los Angeles, \$8,772; Werner & Webb, Los Angeles, \$9,482; John Higgins, Huntington Park, \$10,195. Contract awarded to Oberg Bros., Los Angeles, \$6,931.50.

VENTURA COUNTY At Santa Paula Creek near Santa Paula, a reinforced concrete box girder bridge to be constructed and about 0.1 mile of roadway to be graded and surfaced with plant-mixed surfacing. District VII, Route 79, Section 8P, B. J. S. Metzger & Son, Los Angeles, \$85,553; Marco Construction Co., Clearwater, \$87,522; A. S. Vinnell Co., Alhambra, \$88,579; Paul J. Tyler, Oroville, \$89,902; United Concrete Pipe Corp., Los Angeles, \$93,842; J. E. Haddock, Ltd., Pasadena, \$95,034; Clyde W. Wood, Los Angeles, \$96,539. Contract awarded to Byerts & Dunn, Los Angeles, \$82,624.50.

YOLO AND COLUSA COUNTIES—Between ¾ mile north of Cache Creek Bridge and Bear Creek Bridge, about 6 miles, a graded roadbed to be constructed on portions thereof, gravel base to be placed and penetration oil treatment to be applied. District III, Route 50, Sections A, A. Harold Smith, St. Helena, \$70,487; Harms Brothers, Sacramento, \$73,350; Hemstreet & Bell, Marysville, \$74,739; Heafey-Moore Co. & Frederickson & Watson Construction Co., Oakland, \$75,712; Claude C. Wood, Lodi, \$76,628; The Utah Construction Co., San Francisco, \$76,760; Lee J. Immel, Berkeley, \$76,820; Guerin Bros., San Francisco, \$80,682; A. Teichert & Son, Inc., Sacramento, \$81,702. Contract awarded to Young & Son Co., Ltd., Berkeley, \$67,821.60.

YOLO COUNTY—Between 7 miles north of Madison and 2.5 miles south of Dunnigan, about 5.7 miles to be graded and treated with penetration oil treatment. District III, Route 90, Section B, N. M. Ball Sons, Berkeley, \$69,661; Harms Bros., Sacramento, \$69,697; Hemstreet & Bell, Marysville, \$69,892; Louis Biasotti & Son & H. Earl Parker, Marysville, \$73,729; Parish Bros., Los Angeles, \$77,175; A. Teichert & Son, Inc., Sacramento, \$79,673; J. R. Reeves, Sacramento, \$80,552; M. J. B. Construction Co., Stockton, \$82,409; Claude C. Wood, Lodi, \$80,894; Valley Construction Co., San Jose, \$81,512. Contract awarded to Frederickson Bros., Emeryville, \$65,501.50.

C. R. Gallagher Wins Scholarship

C. R. Gallagher, Structural Engineering Office Aid in the Safety Department of the Division of Highways, has been awarded one of the Alfred P. Sloane, Jr. fellowships in Traffic Engineering in the Bureau of Street Traffic Research at Yale University, for the current academic year. He is one of seven engineers chosen from State Highway Departments as recipients of awards.

Mr. Gallagher was graduated from the University of California, College of Civil Engineering, in 1937. He formerly worked for the Bridge Department and for the last year has been with the Safety Department.

He recently left for New Haven, Connecticut, where he will be in residence for the school year.

First Unit of 'Industrial Highway'

(Continued from page 20)

this section of the route include provisions for a four-lane pavement and the new unit was so constructed that when the traffic volume requires the additional width the highway may be transformed into a four-lane roadway with no loss of the present investment and a minimum interruption of traffic.

The pavement of the new unit was placed upon a crushed rock base and at certain locations across the floor of Diablo Valley the earth sub-base was stabilized by mixing Portland cement with the native material to insure the roadbed against distortions.

About 50,000 square yards of soil base which were stabilized required 4000 barrels of cement. Approximately 500,000 cubic yards of material were moved.

Cross-drains and underdrains which were placed in the roadway prism to provide sufficient drainage facilities included nearly 9000 linear feet of corrugated pipe. Approximately 38,000 tons of rock and over 1000 tons of liquid asphalt were used in construction of the crushed rock base and plant-mixed surfacing.

Three reinforced concrete slab bridges, one across Walnut Creek and the others across Grayson Creek and Grayson Creek overflow channel were built.

The bridge across Walnut Creek has a total length of 203 feet, consisting of four spans of 36 feet 4 inches and two spans of 27 feet 4 inches, reinforced concrete slabs supported on concrete pile bents. Grayson Creek bridge is 81 feet long, consisting of three spans each 22 feet long with a 7-foot 6-inch cantilever span at the ends.

The bridge over Grayson Creek Overflow is 147 feet long, consisting of six 22-foot spans with 7-foot 6-inch cantilever spans at each end. All of the bridges are continuous reinforced concrete slab type of structures supported on reinforced concrete pile bents. The Walnut Creek Bridge has two expansion joints located at the quarter point of the second span from each end. Grayson Creek Bridge is

In Memoriam

Eli Dallas, Associate Highway Engineer employed at Redding in District II, Division of Highways, passed away on August 9, 1939, after a protracted illness.

Eli Dallas was born at Auburn, Kansas, on November 14, 1880. During his early life he devoted his attention to railroad engineering in the middle west and southwestern states, principally on construction and location projects. In 1914 he came to Southern California and in April the following year entered the employ of the State in District II as a draftsman. During his twenty-four years in the district he rose to the position of chief draftsman, in which capacity he rendered conscientious and valuable service to the State until his death.

In 1905 Mr. Dallas, at Topeka, Kansas, married Auta Pearl McWhinney, who with a daughter Frances Lucille, and twin son and daughter John Paul and Auta Pauline, survive him.

The many friends and fellow employees of Eli Dallas who were associated with him during his long service with the Division of Highways deeply regret his passing.

W. W. PATCH

W. W. Patch, one of the first division engineers of the State Division of Highways, died August 9 in Los Angeles of a heart attack.

He entered the service of the State in 1914 as Division Engineer of Division VII, succeeding Division Engineer W. L. Clark in charge of the Los Angeles metropolitan area with headquarters in Los Angeles, and continued in that office for nine years.

He resigned January 1, 1924, to enter the real estate business and at the same time continue engineering work in a consulting capacity.

He was succeeded by Spencer V. Cortelyou, present District Engineer of District VII, who had been his assistant for many years.

Mr. Patch later entered the employ of the Los Angeles Flood Control District, with which he was connected up to the time of his death. During recent months in that service he was on sick leave.

Before coming to the Division of Highways Mr. Patch worked for the Federal government as engineer on reclamation projects in the eastern States. During the period in which he was in charge of the Los Angeles office, he supervised the expenditure of more than twelve million dollars in primary construction work on State highways in the south.

Notable work done under his supervision included the grading and paving of the original Ridge Route.

continuous from end to end without expansion joint and the Overflow Bridge has an expansion joint in the third span of the west end.

The bridges have 27-foot clear roadway between curbs with 2-foot 6-inch sidewalks on each side. When traffic requires construction of a four-lane highway the additional lane will be provided by the construction of a similar bridge alongside without disturbing the existing structures.

Within the limits of this road project a separate contract was let for the construction of a grade separation under the tracks of the Sacramento Northern Railway at Ohmer Station. The grade separation includes a steel and concrete bridge 103 feet long to carry the railroad over the highway and, in addition, a reinforced concrete slab bridge 110 feet long located about 90 feet west of the railroad structure, to carry the Concord-Port Chicago County Road over the new highway.

The railroad structure consists of three spans each approximately 34 feet long, the center span being over the new two-lane highway and its one 4-foot sidewalk. The north span is constructed to permit extension of the structure at such time as two additional lanes are added to the highway. Six lines of 24-foot steel beams support the single track railway. The ballast deck is supported on wrought iron plates. The structure has reinforced concrete fascia girders.

The county road bridge has three spans with provision for spanning the future four-lane highway similar to the railroad structure. The grade separation project was financed from Federal Aid Grade Crossing Funds. Maceo Construction Co. were the contractors for this work, as well as for the major highway project.

Trucking Operation Contrasts

Wide contrasts are shown in motor trucking operations, with most truck runs relatively short, but major mileages returned by trucks in long-haul duty, according to the Automobile Manufacturers Association.

Studies show that more than 80 per cent of all one-way truck trips extended less than 20 miles but accounted for less than 34 per cent of the total truck mileage reported.

By contrast, only 6.4 per cent of trips were 50 to 500 miles in length, but they accounted for 41.2 per cent of total vehicle mileage.

State of California

CULBERT L. OLSON, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

FRANK W. CLARK, Director of Public Works

CALIFORNIA HIGHWAY COMMISSION

LAWRENCE BARRETT, Chairman, San Francisco

IENER W. NIELSEN, Fresno

AMERIGO BOZZANI, Los Angeles

BERT L. VAUGHN, Jacumba

L. G. HITCHCOCK, Santa Rosa

BYRON N. SCOTT, Secretary

DIVISION OF HIGHWAYS

C. H. PURCELL, State Highway Engineer

G. T. MCCOY, Assistant State Highway Engineer

J. G. STANDLEY, Principal Assistant Engineer

R. H. WILSON, Office Engineer

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FRED J. GRUMM, Engineer of Surveys and Plans

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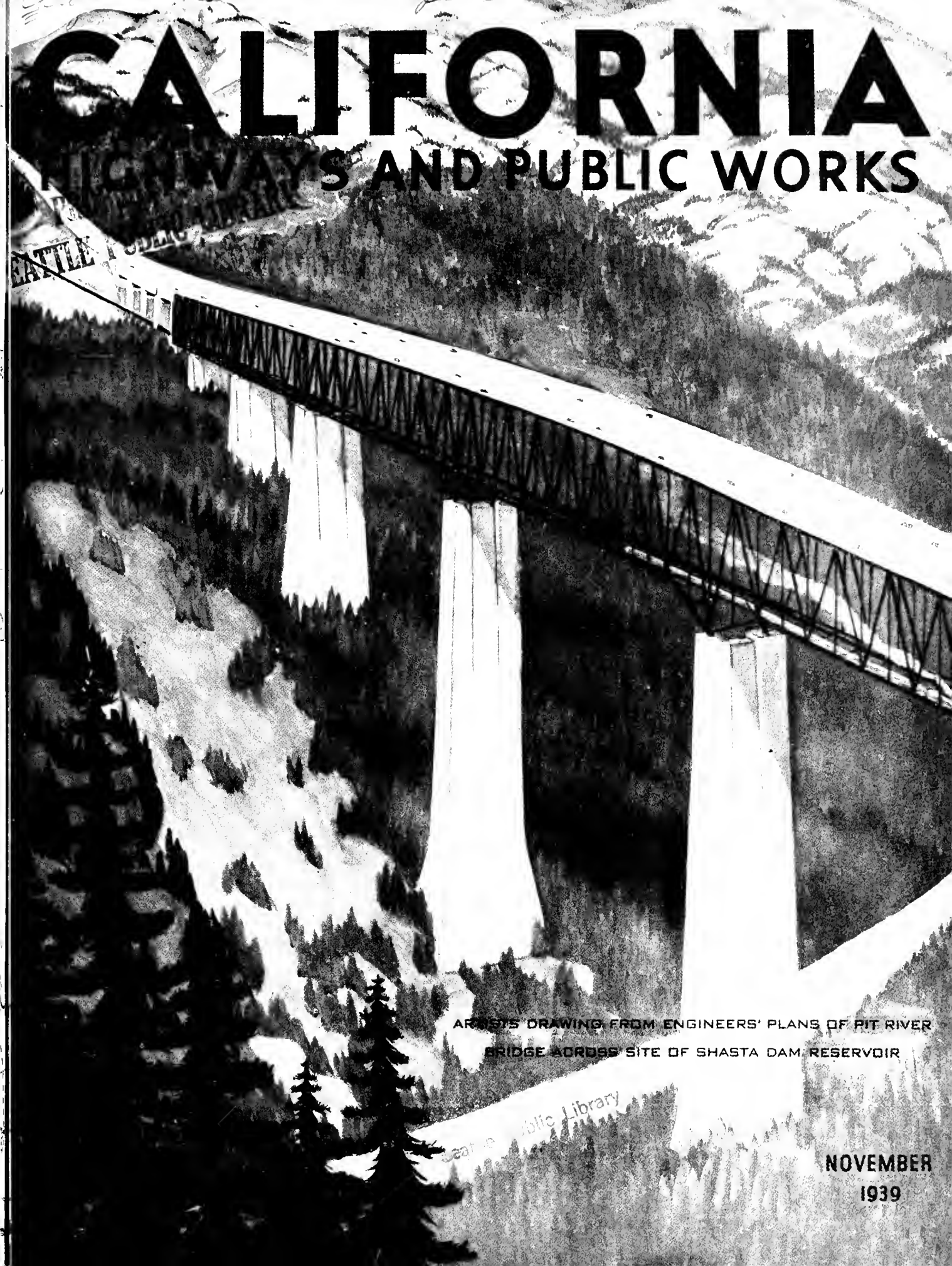
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MAP
SHOWING
STATE HIGHWAY SYSTEM

LEGEND

Primary Roads —————
Secondary Roads - - - - -
Proposed Roads = = = = =





CALIFORNIA

HIGHWAYS AND PUBLIC WORKS

ARTIST'S DRAWING FROM ENGINEERS' PLANS OF PIT RIVER
BRIDGE ACROSS SITE OF SHASTA DAM RESERVOIR

Seattle Public Library

NOVEMBER
1939

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

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State Joins U. S. in \$3,200,000 Contract for Highway Relocation Around Shasta Dam Reservoir

By C. H. PURCELL, State Highway Engineer

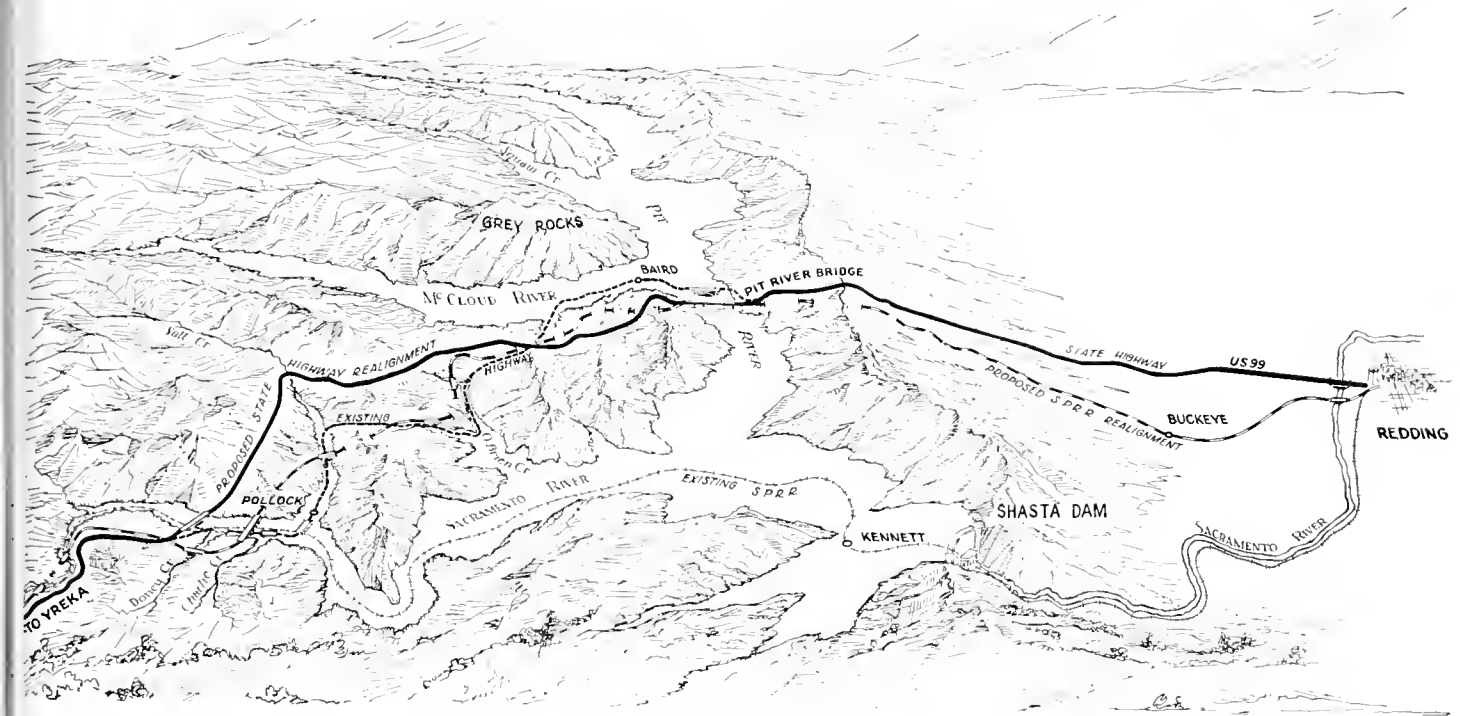
FURTHER participation by the State of California in the Central Valley project was inaugurated this month when Director of Public Works Frank W. Clark signed a contract between the U. S. Department of the Interior and the Department of Public Works providing for the relocation around Shasta Dam of the Pacific Highway, U. S. 99. At the

share of the expense of these projects will be contributed by the Federal government, the Department of the Interior has requested the State to do the actual construction work.

When Shasta Dam across the Sacramento River about thirteen miles from Redding is completed, the reservoir formed back of it will have a high water level of 1065 feet and will

miles of the Pacific Highway (State Highway No. 3) will be abandoned and will be replaced by 15.35 miles of new construction which may cost approximately \$3,200,000, including engineering, rights of way and construction.

This estimated figure includes no portion of the cost of the mammoth Pit River Bridge, an important unit



Map showing relocation of State Highway (U. S. 99) from Redding north around and across Shasta Dam Reservoir.

same time Mr. Clark instructed the Division of Highways to advertise for bids for realigned highway construction between Bass Hill and O'Brien Summit and the erection of a bridge across the Sacramento River near Antlers, both projects in Shasta County.

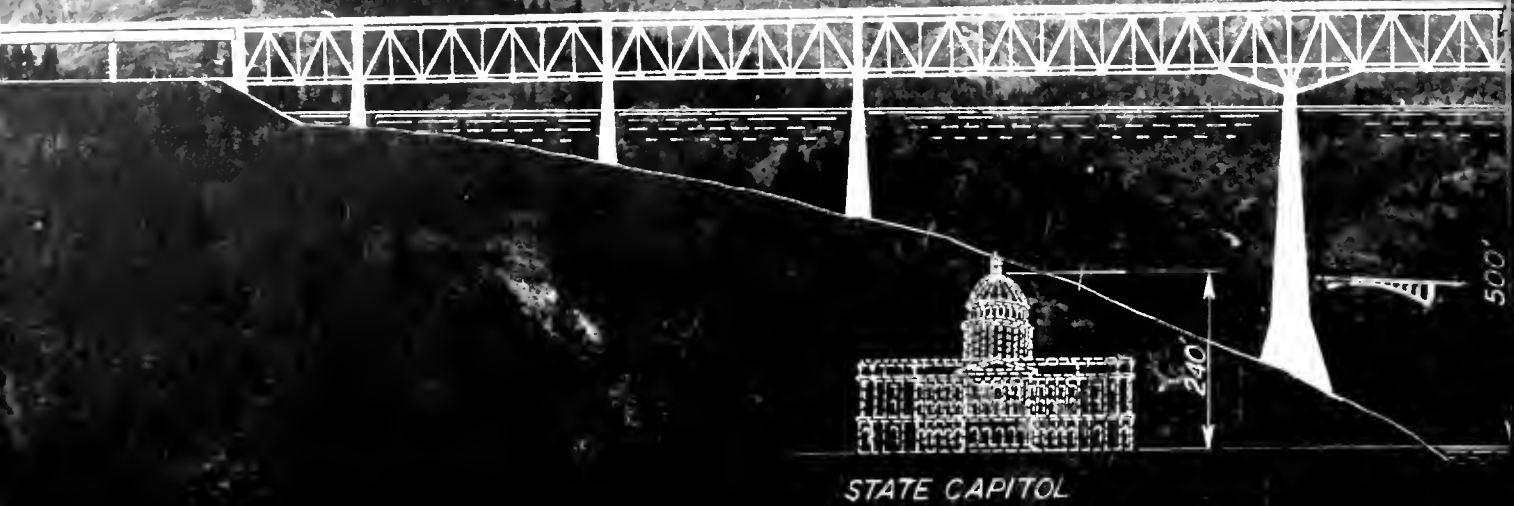
These two units of the highway relocation will cost approximately one million dollars. While the greater

flood the canyons of the Pit, McCloud and Sacramento Rivers for many miles. This will necessitate relocation of a number of existing utilities, among which are the Southern Pacific Railroad, telephone, telegraph and power transmission lines, county roads and a portion of the Pacific Highway.

To clear the flooded area and to avoid conflict with the relocation of the Southern Pacific Railroad, 19.5

of the relocation program which will be constructed by the U. S. Bureau of Reclamation.

Negotiations between the Bureau of Reclamation and the State relative to the replacement of the highway extended over a period of eighteen months. The agreement recently signed by Director Clark sets forth the terms under which the new highway will be located and constructed



Sketch of Pit River bridge on photo of site showing double-decked, highway-railroad structure, 3,587 feet long as seen in background and inset sketch

and provides the formulae for division of cost.

All location work is being done by the State. All but two parcels of right of way are being acquired by the Bureau of Reclamation. One of these parcels acquired by the State extends beyond the area of Bureau participation, and the other is across an Indian allotment where the State is handling the transaction for technical reasons.

STATE AND U. S. SHARE COST

One construction contract 2.3 miles in length is being handled by the Bureau of Reclamation. The remainder of the construction, exclusive of the combination railroad and highway bridge across the Pit River, will be done by the State.

Because of minor extensions of the highway relocation beyond the exact limits necessary to clear the Central Valley features and because of some improvements in standards of location over those of the existing highway, the State will contribute to the cost of relocation, although the greater portion of the cost, or approximately 85 per cent, will be borne by the Federal government.

For many years reclamation and flood control works essentially the

same as those embodied in the Central Valley project have been the dream of engineers and the hope of the citizens of California. During this period many studies and estimates were made, among which were tentative proposals for relocation of the highway and estimates of its cost. Early in 1935, when it appeared that the actual construction of the project was near at hand, more intensive studies for highway relocation were undertaken by the Division of Highways, and preliminary surveys were authorized.

It was apparent from the start that the requirement given us of keeping the location above the 1100-foot contour necessitated the development of a new location in a forbidding territory, through which no one would have the temerity to locate a highway by choice. While all possible alternate locations were investigated, it soon became evident that one location, formidable though it was, stood out above all others as the economic and preferable one. Since the beginning in 1935, studies have been carried on almost continuously until at this time the final location has all been determined, and the last of the plans is nearing completion.

The beginning of this relocation is

on the Pit River side of the divide at Bass Hill, 12.5 miles from Redding. About 0.6 of a mile from Bass Hill, the relocation crosses the Pit River on the upper deck of a long, high bridge that carries the Southern Pacific Railroad on its lower deck. After crossing the Pit River, the relocation follows the broken range that forms the divide between the Sacramento and McCloud River drainages.

There will be three distinct summits on the highway relocation, the highest of which will be 605 feet above the highest level of the lake. About 10 miles from Bass Hill the relocation descends and crosses the Sacramento River near the present railroad station of Antler, thence under the relocated Southern Pacific Railroad and northerly about three miles farther. The necessity for reconstructing the latter three miles arises from conflict of the relocation of the Southern Pacific Railroad with the existing highway.

ROAD ON HIGH GROUND

Contrary to popular conception, the relocated highway will not be a lake-shore drive. The elevation of the highway ranges from 35 to 605 feet above the highest elevation of the lake. There will be but few locations



above river bed. Two piers will be highest concrete piers in world exceeding 350 feet. Existing bridge is Capitol gives a height comparison.

where any portion of the lake is visible from the highway.

The northerly 2.3 miles of relocation is necessary because the railroad relocation occupies portions of the old highway. To avoid conflict between contractors, which would be inevitable if two simultaneous contracts were let, it was decided that this 2.3 mile unit would be built by the Bureau of Reclamation and would be included in the contract for grading the adjoining portion of the railroad relocation. Since there were seasonal limitations on the time in which the highway work could be done and since the highway had to be completed before portions of the railroad grading could be done, it seemed the wise policy to sell to a single contractor, the job of coordinating the two jobs.

The contract that included this unit of highway was awarded by the Bureau of Reclamation to Granfield, Farrar and Carlin in March, 1939. The contract is nearing completion. Weather permitting, the job should be finished this month.

The remaining 10.2 miles will be constructed by the State. The present plan calls for four contracts. One on which bids will be opened on November 22, is for grading from Bass Hill northerly for 4.73 miles to O'Brien

Summit. There will also be included in this contract a concrete bridge 377 feet long, located on a very steep hillside some 290 feet above the portal of one of the railroad tunnels. The grading to be done under this contract is on either side of the Pit River. The Bureau of Reclamation has awarded a contract for the substructure for the Pit River bridge, and this contract provides for the construction of the highway abutments in time for the highway grading contractor to make the approach fills. The construction of this unit includes 1,018,000 cubic yards of excavation.

The second contract, on which bids will also be opened November 22, will be for the construction of a highway bridge across the Sacramento River at Antler. This bridge will be 1330 feet long and will be constructed on an average of 3.6 per cent grade. The portion of the bridge over the channel will be 210 feet above the river bed.

The bridge will consist of five continuous deck trusses with the central span of 272.8 feet flanked by spans of 251.8 and 189 feet and cantilever arms 42 feet long. From the abutments to the cantilever arms are suspended girder spans of 52 and 39.7 feet.

BRIDGE DESIGN

Piers will be hollow concrete construction. The largest will be 172.65 feet high, 18 by 44 feet at the base and 8 by 40 feet at the top.

Foundation tests by the open pit method showed all piers but one to have hard andesite bedrock for foundation and the one to have firm rock unaffected by water.

The roadway across the bridge will be 50 feet wide flanked by two 2-foot 6-inch sidewalks. The bridge will be constructed on a 5000-foot radius curve compounding about 80 feet from the southerly end to an 800-foot radius curve. A slight crown provided by appropriate vertical curves and a specially designed, elongated superelevation is expected to eliminate all appearance of distortion at the point where the 800-foot and 5000-foot radii compound.

Construction of this bridge will require 18 months, and it will be completed in May, 1941.

FUTURE CONTRACTS

The third contract will be let early in 1940 and will be for grading 8.31 miles between O'Brien Summit and the contract just completed by the Bureau of Reclamation. The grad-

ing of this unit involves 1,500,000 cubic yards of excavation.

The fourth contract, which will be let as early as possible in 1941, will consist of surfacing the 13.04 miles involved in the two grading contracts. Except for a short stretch of portland cement concrete pavement, a portion of which through the subway under the Southern Pacific railroad at Antler will be four-lane divided, the surfacing will consist of 6 inches of crusher run base over the entire roadbed, 22 feet by 21 feet of plant-mixed surface and crushed rock shoulders. The gross width of the roadbed will be 30 feet. The graded width and type and stability of surface will be comparable to that on the

structure, including the separate approaches, is 3587.7 feet. The roadway will be 44 feet wide with sidewalks 2.5 feet wide on each side.

The highway grade will be in excess of 530 feet above the river bed. However, after Shasta Dam is completed about eight miles down stream from the bridge, water eventually will back up in the tributary Pit River canyon to within 35 feet of the lower deck of the bridge.

MAMMOTH PIERS

Two of the Pit bridge piers will exceed 350 feet in height and will be among the highest in the world. The tallest pier will be 358 feet high and 95 by 90 feet in size at the base.

backfill, placing 95,000 cubic yards of concrete, and eleven million pounds of reinforcement bars, installing 27,000 pounds of tubing for concrete cooling and 20,000 pounds of miscellaneous metal work.

The existing Pit River bridge, an old concrete structure, is not worth salvaging and will be submerged by the reservoir waters backed up by Shasta Dam.

The United States Government will retain title to the new bridge and all land, rights of way, and appurtenances necessary for the operation and maintenance of the structure, but the Federal government will grant to the State, under the agreement signed by Director Clark, a



One section of newly completed relocation of State Highway 3 (U. S. 99), north of La Moine in Shasta County.

existing highway which will be relinquished to the Bureau on completion of the relocation.

PIT RIVER BRIDGE

A major unit of the new highway will be the Pit River Bridge to be constructed by the Bureau of Reclamation. The central portion of this bridge will consist of a central 630-foot cantilever truss span, two 497-foot, three 282-foot, two 141-foot deck truss spans, one 150-foot and four 141-foot deck girder spans.

Provision will be made for two railroad tracks through the trusses and for a four-lane highway over the top. At the end of the major spans, the railroad and highway will go their own separate ways by special design that separates them horizontally.

The total length of the highway

Another pier will be 356 feet high and 95 feet square at the base, and a third, 271 feet high and 72 by 58 feet at the base. The concrete in these three largest piers will be artificially cooled by the circulation of river water through metal tubing embedded in the structures, a practice developed by the Bureau of Reclamation and heretofore used only in the construction of giant dams.

The substructure of the Pit River bridge will include four concrete abutments—two for the railroad and two for the highway—and ten concrete piers to support the double deck steel structure that will total two-thirds of a mile in length.

The substructure job, for which 16½ months will be allowed for completion, will include 276,000 cubic yards of excavation, 243,000 cubic yards of

perpetual easement sufficient for highway purposes, this grant to be made at or prior to the time the State abandons its existing highway facilities and reroutes highway traffic to the relocated highway.

MAINTENANCE COST SHARED

It is agreed that the cost and expense of maintaining the Pit River bridge shall be borne by the Federal government and the State, California to bear that portion of the total cost and expense as is equitably attributable to the operation of highway facilities. The apportionment of this cost will be the subject of a separate contract to be entered into between the United States and the Department of Public Works prior to the date the State abandons its present highway facilities.

(Continued on page 16)



Construction scenes on highway relocation in Shasta County, showing grading operation, a completed section and building fill over large culvert.



Section of new highway in Kings River Canyon between Grizzly and Boulder Creek showing glimpse of rugged south wall of canyon.

Kings River Canyon Highway Opened

By E. T. SCOTT, District Engineer

OPENING up thousands of square miles of wilderness recreational areas, the Kings River Canyon Highway was officially dedicated to public service on Sunday, October 29.

California Highway Commission members, representatives of the U. S. Forest Service, officials of chambers of commerce of Fresno, Tulare and neighboring counties, automobile clubs and civic organizations and legislators joined with many visitors in dedicatory ceremonies held at Cedar Grove, where a luncheon was served.

Completion of the Kings River Canyon highway climaxes ten years of construction work.

With the exception of about five miles of early construction, the project has been built to a roadway width of twenty feet. The entire roadway width has been surfaced with native material. On a large portion of the highway, this surfacing consists of disintegrated granite placed to a depth of seven inches.

Two contracts for bituminous treatment of the surfacing have been completed as the final work on furnishing

a modern mountain highway up the canyon. One contract involved a road-mix surface treatment to 47.3 miles from Stafford's Corner, north of Woodlake, in Tulare County on State Route 129, to General Grant National Park and east of the park to the South Fork of Kings River. The other contract provided a similar treatment from the Kings River bridge over the 6.5 miles to Deer Cove Creek.

Dropping deep into the canyon from heights among the clouds overlooking the expanse of the San Joa-



Parking area at confluence of North and South Forks of Kings River showing new highway winding down into South Fork Canyon.



quin Valley to the west, and High Sierra to the east, the Kings River Canyon Highway offers panoramic views of mountain grandeur not easily to be forgotten, such as views of mountain massives, peaks of sheer granite rising to dizzy heights, pinnacles and deep canyons, and all on a tremendous scale.

The highway extends from the northerly boundary of General Grant National Park through Indian Basin, dropping down to Lookout Point, where a gorgeous panoramic view unfolds, and thence winds on down grade to Yucca Point. Here an inspiring view is to be had of the river named by the Spaniards in 1805, El Rio de los Santos Reyes (River of the Holy Kings). From here one can see the confluence of the Middle Fork and the South Fork of the Kings River, both extending miles back into steep walled gorges, scoured by glaciers in ancient times.

Winding on down hill on gentle grades and easy curves the highway is carved in the granite of the canyon wall of the South Fork of Kings River. The river is finally reached at Windy Cliff, about eighteen miles distant from General Grant Park.

Here the rock formation suddenly changes. A great limestone dike rises almost vertically to a height of fifteen hundred feet above the river, exquisite mountain sculpture. Nor are these natural carvings limited to the surface of the limestone formations.

Near Windy Cliff is to be found the entrance to Boyden Cave, a cavern extending several hundred feet into the great dyke. Galleries and grottoes carved in the limestone, ornamented with statuary of weird design; groups of stalactites and stalagmites, increasing in numbers as one walks further into the cavern. Strong currents of air are felt, apparently from crevices not yet explored, perhaps from an outside opening somewhere.

From the foot of the trail leading to Boyden Cave a large parking area has been provided for automobiles. At this point a bridge takes the highway across to the northerly side of the Kings River and thence it follows along the river past Boulder Creek and by Grizzly Creek, where a high

At top—A scene on the floor of the valley east of Cedar Grove where trees and river background against a series of scarred, bulking cliff masses rising straight up toward the skyline. At bottom—Along the river near Deer Cove Creek.

waterfall and spray from that stream can be seen through the trees.

At Deer Cove the highway constructed by the State comes to an end, but the road does not end here. The Forest Service has built the highway from Deer Cove on upstream to Cedar Grove. Here a large area among the trees has been prepared with all conveniences and comforts for a fine picnic and camping grounds.

The highway along the river presents a scenic contrast to views from Lookout Point. Winding gently along shaded aisles of a forest of dense growth, then breaking out into flowery meadows. In a rock walled canyon, through groves of Oak, Incense Cedar, Laurel and Ponderosa Pine. And always towering above the woods, the polished domes and spires of granite, reaching upward. And below the restless mountain torrent swirling down the gorge, its flow checked by deep silent pools, and hindered by long rapids and numerous cascades. This is the South Fork of the Kings River.

This most scenic highway was adopted as a route by vote of the State Highway Commission in 1928. In June of the following year work was commenced and was continued until its completion in October, 1939. Many engineers now in the employ of the Division of Highways have taken part some time or other in this engineering and construction project.

Mr. E. E. Wallace was District Engineer during the location of the Kings Canyon Highway and during the first years of its construction.

Mr. R. M. Gillis was District Engineer from 1933 to 1938, during the heaviest part of the construction work on this project.

The Kings River Canyon project covered a distance of 24.5 miles and was built at a cost of nearly \$2,300,000. Mr. R. C. McFarland was Construction Superintendent during nearly the entire period of work, while Mr. R. S. Badger was District Construction Engineer.

The formal dedication ceremonies were conducted at Cedar Grove attended by approximately 2000 citizens representing civic organizations

(Continued on page 23)

At a bend of the highway east of Boulder Creek a pair of towering, pointed half domes suggestive of Yosemite greet the eye, as shown in top photo. Below—The highway skirts the base of massive cliffs.



Divided Highway Completed Between Colton and Riverside

By A. EVERETT SMITH, Assistant Highway Engineer

A CONTRACT for constructing a portion of State highway from Colton southerly on La Cadena Drive for a distance of three miles was completed October 14.

This project is located between the cities of Colton and Riverside, State Route 43, and is on the Mountains to the Sea Highway via the Santa Ana Canyon. In addition to heavy periods of recreational traffic between the beach areas and the mountain resorts, this highway section serves intensified traffic originating in the San Bernardino and Colton areas on one side and the Riverside and March Field areas on the other.

the project, with curbs forming a central dividing strip between the north and southbound traffic lanes. The old pavement, which is now used by northbound traffic, was, for the major part, unchanged under this contract, except for the addition of surfaced shoulders and curbs.

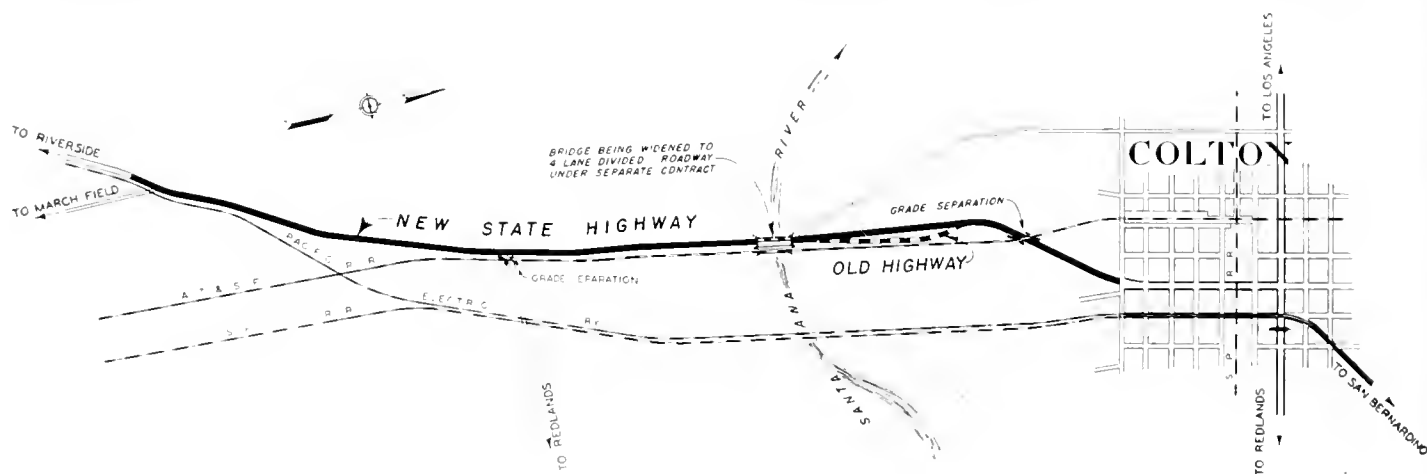
As the new lanes were constructed to modern gradient and alignment standards and as the existing pavement for the most part was unchanged, the highway presents a dual section with a two-level profile, and a variable width between dividing curbs.

By utilizing the existing pavement

timber guard railing was placed at locations where the difference in elevation of the two grade lines was such that steep fill slopes resulted between the two-level roadway sections.

A covering of top soil was placed on sandy cut slopes and between curbs in the divisional strip to facilitate planting, in connection with future beautification work and erosion control of the vulnerable slopes.

The new section for southbound traffic was constructed to the Division of Highways standards for a four-lane, divided highway with the inside lane twelve feet in width and the outside lane eleven feet in width. This



Before this improvement was made there was available to motorists at this point only a two-lane road, which carried traffic that exceeded 8000 vehicles a day by regular traffic count. During such periods of heavy traffic, the rate of speed for all vehicles was reduced to that of the slower vehicles on the road as passing to the left was seriously hindered by oncoming traffic, as well as by numerous limitations of sight distance at horizontal and vertical curves.

To correct these conditions an additional two lanes of pavement were constructed from the Santa Ana River Bridge to the southerly end of

for one-way traffic, considerable economy resulted. The difficulties previously encountered, due to limited sight distance resulting in the impeding of traffic and hazards involved in passing, are now eliminated, the amount of necessary sight distance being greatly reduced as no oncoming traffic is encountered. Thus, the same two-lane pavement section that was inadequate for heavy two-way traffic admits a rapid and uniform flow of two-lane traffic in one direction.

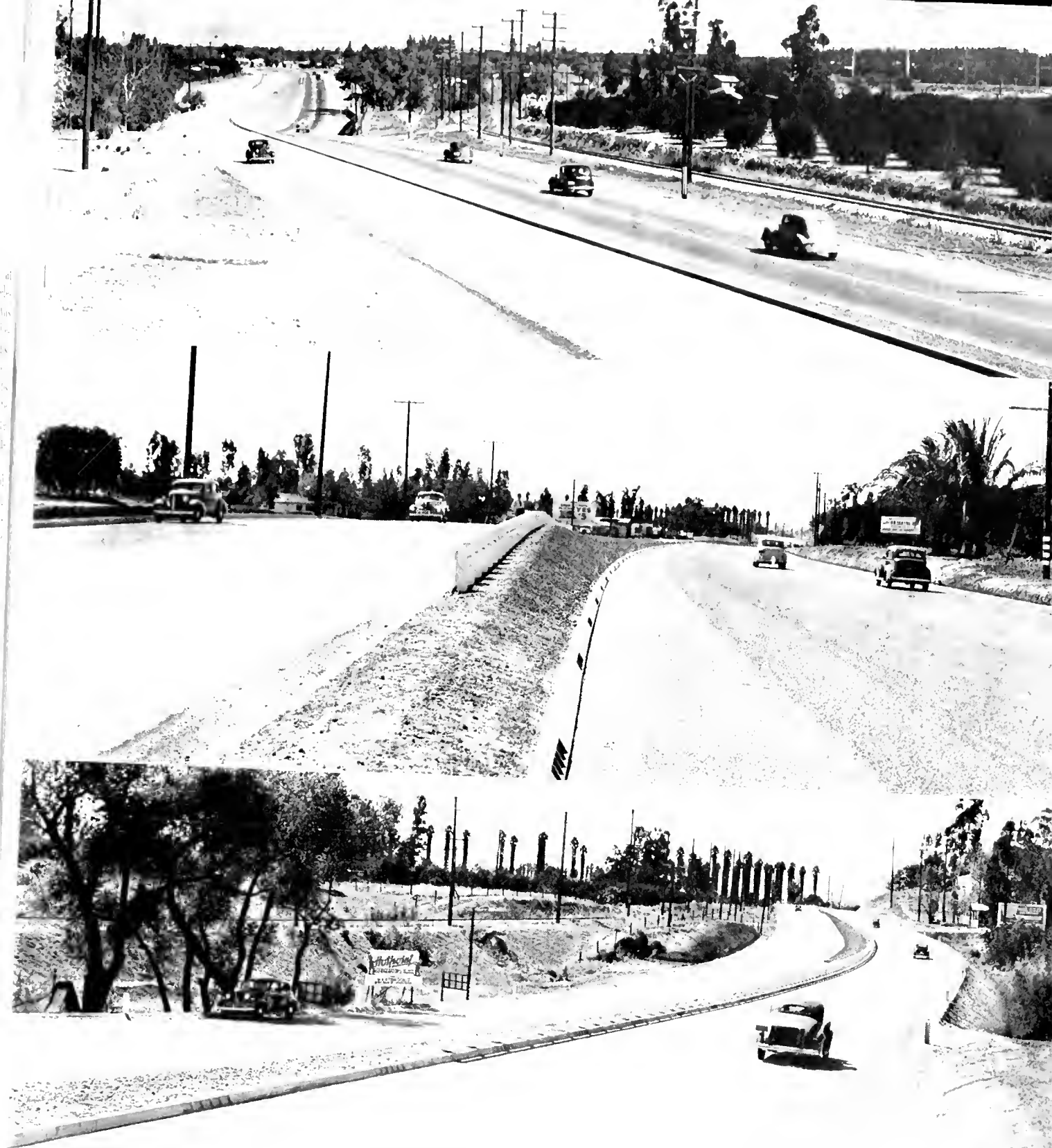
Portland cement concrete curbs for the dividing strip are of the recessed panel type to provide greater visibility during night driving. Laminated

is bordered by a seven-foot surfaced shoulder.

At the intersection with the road leading to Redlands a special design for channelization of traffic was adopted. This design, in addition to facilitating entry to the highway, provides stopping space outside of the driving lanes for cars making left turns across oncoming traffic.

At the Santa Ana River Bridge a separate project is now under way for constructing a bridge adjacent and parallel to the existing bridge to carry the four-lane, divided highway section across the river. This struc-

(Continued on page 28)



Top—Recently completed divided highway between Colton and Riverside on State Route 43 showing central dividing strip separating old pavement on the left from new lanes on right and guard rail in place where there is considerable difference in elevation. Center—Treatment of dividing strip transition is shown between locations where highways are on different levels. Bottom—Close up of two different level sections.

Annual Convention of Highway Officials Develops New Ideas

By LAWRENCE BARRETT and L. G. HITCHCOCK, State Highway Commissioners

California was represented at the twenty-fifth annual convention of the American Association of State Highway Officials held at Richmond, Virginia, October 9-12, by officials of the Division of Highways and the State Highway Commission designated by Governor Culbert L. Olson and Director of Public Works Frank W. Clark. Chairman Larry Barrett of San Francisco and Commissioner L. G. Hitchcock of Santa Rosa attended as delegates from the Highway Commission and in the following article, jointly written, give some of their impressions of the convention.

ON OCTOBER 3, 1939, our Honorable Governor, Culbert L. Olson, addressed a letter to the State Controller granting permission, as required by law, to the writers of this article and six members of the Division of Highways, Department of Public Works, to attend the Twenty-fifth Annual Convention of the American Association of State Highway Officials at Richmond, Virginia.

In that letter the Governor stated: "It is believed desirable that these officials of the State Highway Department be permitted to attend this Convention for the purpose of acquainting themselves with the functions of this Association, and the assistance it will render them from an administrative standpoint in such matters as public relation, coordination between State Highway Departments and various Federal agencies, future Federal participation, advantages and disadvantages of limited State highway mileages, or control over the entire road system in a State."

In thus summarizing the advantages to be gained by the highway officials in participating in this convention, the Governor again displayed that farsightedness in the approach to public problems that has been so evident in his administration of the affairs of this State. For it can be said now that all of the reasons given by the Governor in his letter of October 3 were substantiated by actual accomplishments during the five days of the convention held in Richmond.

The California official party composed of the writers of this article and Charles H. Purcell, State Highway Engineer; Fred J. Grumm, Engineer of Surveys and Plans; T. H.

Dennis, Maintenance Engineer; F. W. Panhorst, Bridge Engineer; S. V. Cortelyou, District Engineer of District VII; T. E. Stanton, Materials and Research Engineer; and C. C. Carleton, Chief Attorney of Division of Contracts and Rights of Way, met on the opening day of the session at eight o'clock a.m. with more than five hundred representatives from all States in the Union at a breakfast held at the Raleigh Hotel in Washington, D. C., October 9th, to honor the twenty-fifth anniversary of the founding of this great association of highway officials.

At this breakfast meeting, certificates of appreciation were presented by President W. W. Maek, of Delaware, to fifteen of the surviving founders of the Association. All addresses and speeches were dispensed with at this meeting and the personnel of the Association used the time to great advantage in renewing old friendships and acquainting themselves with the new officials who were attending for the first time.

GROUP MEETINGS

The Association was escorted by the Virginia officials, in a caravan, over the beautiful skyline drive from Washington to Richmond. This highway is a monument to the national park service work in highway construction throughout the nation. It traverses the entire length of the Shenandoah National Park, which has often been described as being more beautiful than the Alps.

The trip, however, was a long one and, although abounding in beauty, at its end many of the delegates had a difficult time in bringing conviction

to their own minds that the group meetings scheduled for the evening of October 9th on administrative problems should be carried on as per schedule. However, in the true spirit of duty, the various group meetings got under way and it was long past eleven p.m. before the weary delegates retired to their respective rooms.

It will be interesting to the lay reader as well as the highway workers throughout the State to note some of the administrative problems that were gone into in these group sessions, and although it was impossible for each member of the California delegation to attend all of the group sessions, it can be said that California was well represented throughout the convention.

MANY SUBJECTS DISCUSSED

Some of the group sessions as designated on the program of the convention were: Compensation Insurance for Highway Department Employees with Discussion of Compensation for Superannuated Highway Employees; Public Relations, Particularly in Connection with Selection of Routes on the Basis of Public Need; Control and Operation of the State Highway Patrol by State Highway Departments; Should Cooperative Projects Between Highway Departments and WPA be Carried Out on New Construction or Should They Tend to Be on Additions and Betterments Which Would Relieve Highway Departments of Future Maintenance Costs? Zoning of Rural Highways as Protection Against Advertising and Commercial Use, and the Legislative Control of Billboards Adjacent to the Highways; Methods to Provide Co-

ordination Between the State Highway Departments and Various Federal Agencies; Methods for Insurance of Proper Right of Way for Future Widening of City Streets; Experience of the Various State Highway Departments in the Operation of Divided Four-Lane Highways; Matters of Traffic Control and Safety, Public Relations and Publicity, Uniform Accounting, Matters on Right of Way; Matters of Bridges and Structures, in which our own Bridge Engineer, F. W. Panhorst, read the principal report of the session; Matters of Road Design, Road Construction, Materials and Research, Maintenance and Equipment, Roadside Development.

WELCOMED IN VIRGINIA

The whole field of highway construction and development in America was covered and discussed to the end that new thoughts and new ideas were conveyed from one to the other and implanted in the minds of the highway officials of America to be drawn upon at a future time as opportunity or necessity demands.

On Tuesday morning, October 10th, in the air-cooled auditorium of the Hotel John Marshall, the regular convention session got under way with President Mack, of Delaware, presiding. Following the invocation by Bishop F. D. Goodwin, General S. M. Downs gave the official address of welcome, representing Governor James H. Priece, of Virginia, who had been detained in Washington on official business of State.

General Downs paid high tribute to the highway officials of America and to the work they have accomplished. He recalled the condition of the highways of Virginia only a few years ago and then called our attention to the beautiful highways that exist in that State today, and we, of California, who were able to compare the Virginia roads of the present with the Virginia roads of old, can testify that great improvements have been made in that State.

PURCELL LAUDED

It is proper to mention at this time that throughout the entire nation insofar as we were able to discern in so short a space of time, rapid strides, both in design and construction, have been made by the highway departments of the various states, in cooperation with the United States Bureau of Roads, so that today, we do have

For National Defense

The following resolution recommending construction of an adequate system of Highways for National Defense was passed by the American Association of State Highway officials at its recent annual convention in Richmond, Va.:

Whereas, International conditions are unsettled throughout the world and a state of war exists in many countries, which tend to focus national attention on the subject of Adequate National Defense; and

Whereas, Any well considered plan for National Defense will require a comprehensive system of improved highways for the rapid and efficient transportation of men, equipment, and supplies; and

Whereas, Any system of highways that will serve adequately the military needs of the Nation will likewise be of immediate and continuing value to our people in times of peace, and will be a sound economic investment, whether ever needed for National Defense or not; and

Whereas, The building of a system of highways that is adequate for National Defense will not only add to our tangible national wealth in full proportion to expenditures made, but will also provide sorely needed employment of a diversified nature throughout the Nation; therefore, be it

Resolved, That the attention of the President and the Congress be called to this vital phase of our National Defense problem; and be it further

Resolved, That this Association hereby tenders its service to the President and the Congress, and respectfully suggests that the Public Roads Administration and the State Highway Departments of the several States, the road building agencies of this Nation, are at their disposal for carrying out any road-building program that might be considered essential to a National Defense program.

a highway system throughout the nation of which every citizen of the country can be proud.

Following the address of welcome by Mr. Mack, the convention paid tribute to our own highway engineer, Charles H. Purcell, past president of the Association of State Highway Officials. The excellent work of our own department has been well publicized throughout the United States and were it not for our own modesty, we would say that California is considered one of the leading States in the union in the development of highway engineering and construction.

Some of the notables who attended the convention were Governor Henry H. Blood, of Utah, a past president of the Association of State Highway Officials, who addressed the convention Wednesday, October 11th; Congressman Wilburn Cartwright, of Oklahoma, an ardent advocate of federal assistance in the matter of highway construction, who, with Lindsay C. Warren, of North Carolina, and James W. Mott, of Oregon, represented the House of Representatives at the convention.

CONGRESS REPRESENTED

It is a noteworthy fact that this was the first time in the history of Congress, that both the Senate and House by joint resolution and without a dissenting vote, sent a delegation to a convention of the Association of State Highway Officials. This delegation, in addition to the representatives above named, consisted of Senators Carl Hayden, of Arizona; Harry Flood Byrd, of Virginia, and Charles W. Tobey, of New Hampshire.

On Wednesday evening, the members of the Association and their ladies were the dinner guests of the Virginia State Highway Department. This dinner was attended by Governor Priece who expressed the deep feeling of gratitude that he felt in having the State of Virginia chosen as the place for holding the 25th annual convention of the Association.

The last business session of the convention was held on Thursday, October 12th, and the morning session opened with an address by Henry F. Cabell, of Oregon, on the aims and accomplishments of the state highway departments in promoting safety. This address was fol-

(Continued on page 16)



Heavy equipment constructing underpass for Figueroa Street while traffic proceeds on Temple Street in Los Angeles.

Figueroa-Temple Street Grade Separation in City of Los Angeles

By R. C. MYERS, Assistant District Office Engineer

IMPROVEMENT of one of the most congested intersections in the Los Angeles metropolitan area is being made by the State Division of Highways at Figueroa and Temple Streets in the city of Los Angeles. Grades of these two important thoroughfares are being separated to eliminate the congestion and delay which increasing traffic has gradually brought about over a period of years.

The natural grade of Temple Street at this intersection is somewhat higher than that of Figueroa Street, forming a summit in the grade of the latter street. This topographic feature makes an ideal location for a grade separation, as a comparatively slight lowering of the grade of Figueroa Street as it approaches Temple Street will permit passing under the grade of Temple Street which will be carried

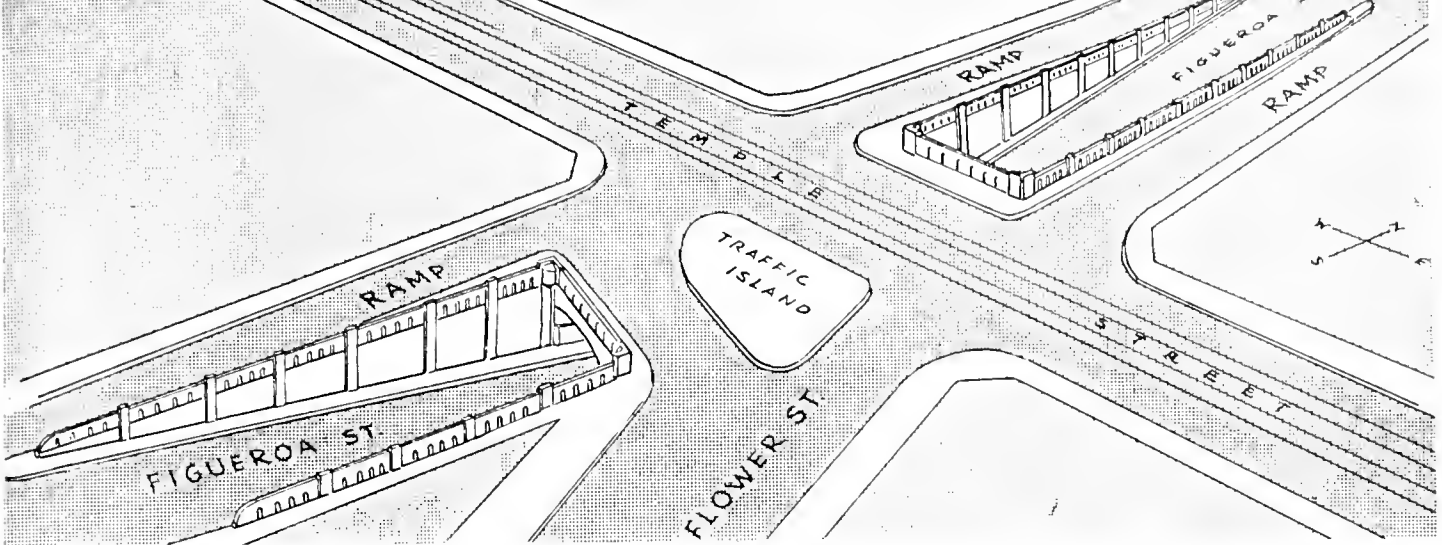
over Figueroa Street on a new bridge being built as a part of the present project.

The new bridge along Temple Street will be a reinforced concrete rigid frame structure having a width between curbs of 56 feet to conform to the width of this street on either side of the structure. The length of the improvement from Sunset Boulevard to Diamond Street is 0.4 mile, which is being constructed to a width of six traffic lanes with the exception of the portion through the underpass crossing Temple Street, which will be four traffic lanes in width.

A heavy reinforced concrete retaining wall on either side of this section will support ramps. Two of these ramps (one on each side) will parallel Figueroa Street northerly of Temple Street, making connection between the grades of these two streets for

both north and southbound traffic. Likewise, a ramp along the west side of Figueroa Street will connect the grades of the two streets southerly of Temple Street. A direct connection to Flower Street will be made at this intersection. Surfacing of the entire length of the project will be of asphaltic concrete.

It is worthy of note that the State, in cooperation with the city, is exercising extreme care in the handling of traffic through the job. The first step in construction was the building of retaining walls, closely followed by the paved ramps so that the large volume of traffic on Figueroa Street could be passed through the job with a minimum of inconvenience. All this was done before excavation was started for the underpass along Figueroa Street, which put the old traveled way out of service.



Sketch of grade separation project at intersection of Figueroa, Temple and Flower streets in Los Angeles.

In order to accommodate Temple Street traffic, the bridge crossing Figueroa Street is being built one-half width at a time. The street car tracks and all traffic are carried over the half not under construction. During the morning and evening rush periods traffic officers of the city of Los Angeles direct traffic at the intersection.

As a part of the present construction contract a drainage system is being built to drain storm waters from the low area south of Temple Street and bounded by Flower Street on the east and Fremont Avenue on the west. Some very heavy reinforced concrete pipe (72 in. and 84 in. in diameter) was used in this installation, which will relieve the

heavy accumulation of water occurring after each rain.

The cost of the contract will be about \$297,000. The required date for completion is December 17, 1939.

This project will, in the near future, be joined on the south by a city of Los Angeles contract from Diamond Street to Second Street, under which the grades of Figueroa and First streets will be separated. These present and pending improvements of Figueroa Street, together with improvements which have recently been made northerly of Sunset Boulevard, will greatly increase the capacity of this street and cut down the traveling time. The usual hazards and delays where major thoroughfares intersect

at grade will be largely eliminated. Driving time will be cut by the resulting continuous flow of traffic at normal speeds rather than by dangerously excessive speeds.

The principal function of this portion of Figueroa Street, from the Los Angeles River north of the tunnels to Second Street, will be to provide an unrestricted outlet into downtown Los Angeles from the Arroyo Seco Parkway, now under construction between Los Angeles and Pasadena.

The "Parkway" will probably be completed early in 1941 and will be a "Freeway" closely following the Arroyo Seco channel ending at the Los Angeles River where connection will be made via Figueroa Street.

Permanent ramps built before excavation began permit Figueroa Street traffic to proceed during construction of underpass.



Annual Convention of Highway Officials

(Continued from page 13)

lowed by a business session wherein the reports of the various committees were made, announcements were read, officers installed, and on reaching the hour of noon, the convention adjourned.

VISIT HISTORIC SIGHTS

Thereafter, the good people of Virginia exemplified further their hospitality by guiding the delegates and their ladies to the various historical points of interest in and around Virginia.

On the following day, many of the State officials journeyed to the historic town of Williamsburg as the guests of Mr. Kenneth Chorley, President of Williamsburg Restoration, Incorporated, and there made a tour of the restored buildings. This great project should be seen by every person in America who is at all interested in our early colonial history.

We believe it was the consensus of the delegates assembled in Richmond that there has been a general tendency on the part of government, both state and federal, to divert funds collected for highway use to purposes other than that for which they are intended and, in this respect, the convention passed a resolution deploring such diversion and urging the Congress of the United States to authorize for expenditure through the Public Roads Administration all the Federal income from the highway users for the construction of the Federal Aid System, forest roads, park roads and public land roads. It may be noted here that it was reported at the convention that the sum of approximately \$150,000,000 per annum has been diverted to purposes other than highway construction.

NATIONAL DEFENSE PROBLEM

It may be further noted that the delegates strongly urged upon the Congress of the United States the matter of considering the highway problem as it is applicable to our national defense, and the Association, by resolution, tendered its services and the services of the road building agencies of the nation to the President and the Congress insofar as that would be possible in the development

and planning of a road-building problem in connection with our national defense program.

It might be pointed out also that during the convention it was brought to the attention of the delegates that throughout the nation and, particularly in the east, there has been a growing tendency on the part of the state governments to secure revenue through exacting tolls and building highways subject to toll. The attitude of the State highway officials is that the United States can be best served by having all its state highways free of tolls and passed a resolution to that effect.

FREEWAYS FAVORED

In line also with the pioneering work done by our California highway officials, the convention went on record in favor of legislation to permit the state highway authorities to build limited access highways in suitable locations; or, in other words, to follow the program already instituted in California of building freeways wherever they are practicable.

The association also recommended to the legislatures of the several states that they enact a uniform code of motor vehicle laws and that cities enact a uniform system of traffic ordinances throughout the nation.

In general, the State highway officials of the United States have recognized that the matter of highway construction and development is no longer a local problem; that if we are to have free and uninterrupted commerce between states, between communities and between farm and market, we must have throughout the United States an integrated system of highways, a safe system of highways, a system of highways that is kept abreast of the technical developments in transportation, and which will give to the average citizen the advantage and pleasure of traveling throughout the length and breadth of the United States in a safe and comfortable manner.

And so we left the State of Virginia instilled with the thought that we could return to California and do a better job for our State and the people living therein, and we are thankful to Governor Culbert L.

Olson and to Frank W. Clark, Director of Public Works, for granting permission to the officials of the department to attend this, the greatest convention ever held by the American Association of State Highway Officials.

State Joins U. S. in \$3,200,000 Contract

(Continued from page 4)

A second structure to be built by the Bureau of Reclamation for highway use is the subway under the relocated Southern Pacific Railroad just north of the Sacramento River bridge near Antler. This structure will consist of a continuous through girder 95 feet 8 inches long, spanning both roadways, with a center support in the dividing strip. Both railroad and highway are on curves at the crossing, and the angle of intersection is 31 degrees 56 feet. Two roadways each 28 feet wide will be provided. The dividing strip 8 feet wide will extend about 230 inches each way from the structure to provide for safety to traffic.

The construction schedule for the several contracts to be let by the Division of Highways contemplates completion of the entire project in October, 1941, or one month after the completion of the relocation of the railroad.

Pit River Bridge Contract Awarded

Announcement was made on November 6 by the office of Secretary of the Interior Harold I. Ickes that the contract award of \$1,138,288 had been made to the Union Paying Company of San Francisco for the construction of the superstructure of the Pit River Bridge. The contractor, it was reported, will begin work next month.

The contract calls for four abutments and ten piers. It requires the superstructure to be completed in 16½ months.

Cities Receive Quarterly Gas Tax Funds for Streets of Major Importance

APPORTIONMENT of the October, 1939, payments of the $\frac{1}{4}$ -cent gasoline tax funds to municipalities for expenditure on streets of major importance has been made by the State Division of Highways of the department of Public Works.

Allocations were made under provisions of the Streets and Highways Code. The cities will receive an additional $\frac{1}{4}$ -cent of the gasoline taxes for use on State highways within their municipal boundaries. These moneys will be expended under supervision of the Division of Highways and will be available when contracts have been entered into between the cities and the State.

The distribution of funds for improvement of streets of major importance is as follows:

District I

City	Population	Amount
Del Norte County:		
Crescent City	1,720	\$449.23
Humboldt County:		
Arcata	1,709	\$446.36
Blue Lake	555	144.95
Eureka	15,752	4,144.12
Ferndale	889	232.19
Fortuna	1,239	323.60
Trinidad	107	27.95
Totals	20,251	\$5,289.17
Lake County:		
Lakeport	1,318	\$344.24
Mendocino County:		
Fort Bragg	3,022	\$789.29
Point Arena	385	100.55
Ukiah	3,124	815.93
Willits	1,424	371.92
Totals	7,955	\$2,077.69
Totals District I	31,244	\$8,160.33

District II

Lassen County:		
Susanville	1,358	\$354.69
Modoc County:		
Alturas	2,338	\$610.64
Plumas County:		
None		
Shasta County:		
Redding	4,188	\$1,093.83
Siskiyou County:		
Dorris	762	\$199.02
Dunsmuir	2,610	681.68
Etna	379	98.99
Fort Jones	302	78.88
Montague	507	132.42
Mount Shasta	1,063	277.63
Tulelake	300	78.35
Yreka	2,201	574.86
Totals	8,124	\$2,121.83

District II—Continued

City	Population	Amount
Tehama County:		
Corning	1,377	\$359.65
Red Bluff	3,517	918.57
Tehama	190	49.62
Totals	5,084	\$1,327.84
Totals District II	21,092	\$5,508.83

District III

Butte County:		
Biggs	463	\$120.93
Chico	7,961	2,079.26
Gridley	1,941	506.95
Oroville	4,742	1,238.52
Totals	15,107	\$3,945.66
Colusa County:		
Colusa	2,116	\$552.66
Williams	869	226.96
Totals	2,985	\$779.62
El Dorado County:		
Placerville	2,367	\$618.22
Glenn County:		
Orland	1,195	\$312.11
Willows	2,024	528.63
Totals	3,219	\$840.74
Nevada County:		
Grass Valley	3,817	\$996.92
Nevada City	1,701	444.27
Totals	5,518	\$1,441.19
Placer County:		
Auburn	2,661	\$695.00
Colfax	912	238.20
Lincoln	2,094	546.91
Rocklin	724	189.09
Roseville	6,425	1,678.09
Totals	12,816	\$3,347.29

Quarterly Gas Tax Paid Cities to Improve

District III—Continued

City	Population	Amount
Sacramento County		
North Sacramento	2,652	\$692.65
Sacramento	93,750	24,485.70
Totals	96,402	\$25,178.35
Sierra County:		
Loyalton	837	\$218.61
Sutter County:		
Yuba City	3,605	\$941.56
Yolo County:		
Davis	1,243	\$324.65
Winters	896	234.02
Woodland	5,578	1,456.86
Totals	7,717	\$2,015.53
Yuba County:		
Marysville	5,763	\$1,505.18
Wheatland	479	125.11
Totals	6,242	\$1,630.29
Totals District III	156,815	\$40,957.06

District IV

Alameda County:		
Alameda	35,033	\$9,149.95
Albany	8,569	2,238.06
Berkeley	82,109	21,445.29
Emeryville	2,336	610.12
Hayward	5,530	1,444.33
Livermore	3,119	814.62
Oakland	284,063	74,191.80
Piedmont	9,333	2,437.60
Pleasanton	1,237	323.08
San Leandro	11,479	2,998.09
Totals	442,808	\$115,652.94
Contra Costa County:		
Antioch	5,183	\$1,353.70
Concord	1,125	293.83
El Cerrito	3,870	1,010.77
Hercules	392	102.38
Martinez	7,931	2,071.42
Pinole	781	203.98
Pittsburg	9,610	2,509.95
Richmond	20,759	5,421.85
Walnut Creek	1,014	264.84
Totals	50,665	\$13,232.72
Marin County:		
Belvedere	500	\$130.59
Corte Madera	1,027	268.23
Fairfax	2,925	763.95
Larkspur	1,241	324.13
Mill Valley	4,164	1,087.56
Ross	1,355	353.90
San Anselmo	4,650	1,214.49
San Rafael	8,022	2,095.19
Sausalito	3,667	957.75
Totals	27,551	\$7,195.79
Napa County:		
Calistoga	1,000	\$261.18

District IV—Continued

City	Population	Amount
Napa	6,437	\$1,681.22
St. Helena	1,582	413.19
Totals	9,019	\$2,355.59
San Francisco County:		
San Francisco	634,394	\$165,691.52
San Mateo County:		
Atherton	1,324	\$345.80
Bayshore	1,149	300.10
Belmont	999	260.92
Burlingame	13,270	3,465.87
Daly City	8,435	2,203.06
Hillsborough	1,891	493.89
Lawndale	369	96.38
Menlo Park	2,254	588.70
Redwood City	8,962	2,340.70
San Bruno	3,610	942.86
San Carlos	1,132	295.66
San Mateo	13,456	3,514.45
South San Francisco	6,193	1,617.49
Totals	63,044	\$16,465.88
Santa Clara County:		
Alviso	381	\$99.51
Gilroy	3,502	914.66
Los Gatos	3,168	827.42
Morgan Hill	908	237.15
Mountain View	3,308	863.99
Palo Alto	13,883	3,625.97
San Jose	62,805	16,403.46
Santa Clara	6,302	1,645.96
Sunnyvale	3,094	808.09
Totals	97,351	\$25,426.21
Santa Cruz County:		
Santa Cruz	14,395	\$3,759.70
Watsonville	8,641	2,256.86
Totals	23,036	\$6,016.56
Sonoma County:		
Cloverdale	759	\$198.24
Healdsburg	2,296	599.67
Petaluma	8,245	2,153.44
Santa Rosa	10,759	2,810.04
Sebastopol	1,762	460.20
Sonoma	980	255.96
Totals	24,801	\$6,477.55
Totals District IV	1,372,669	\$358,514.76

District V

Monterey County:		
Carmel	2,260	\$590.27
King City	1,483	387.33
Monterey	9,141	2,387.45
Pacific Grove	5,558	1,451.64
Salinas	10,464	2,733.00
Soledad	594	155.14
Totals	29,500	\$7,704.83
San Benito County:		
Hollister	3,757	\$981.26
San Juan	772	201.63
Totals	4,529	\$1,182.89

Major Streets Other Than State Highways

District V—Continued

City	Population	Amount
San Luis Obispo County:		
Arroyo Grande	892	\$232.97
Paso Robles	2,573	672.02
Pismo Beach	1,572	410.58
San Luis Obispo	8,276	2,161.53
Totals	13,313	\$3,477.10
Santa Barbara County:		
Lompoc	2,845	\$743.06
Santa Barbara	33,613	8,779.07
Santa Maria	7,057	1,843.15
Totals	43,515	\$11,365.28
Totals District V	90,857	\$23,730.10

District VI

Fresno County:		
Clovis	1,316	\$343.71
Coalinga	2,851	744.63
Firebaugh	506	132.16
Fowler	1,171	305.84
Fresno	53,851	14,064.84
Kingsburg	1,322	345.28
Parlier	564	147.31
Reedley	2,589	676.20
Sanger	2,967	774.92
San Joaquin	163	42.57
Selma	3,047	795.82
Totals	70,347	\$18,373.28
Kern County:		
Bakersfield	26,015	\$6,794.62
Delano	2,632	687.43
Maricopa	1,071	279.73
Shafter	1,263	329.87
Taft	3,442	898.98
Tehachapi	736	192.23
Totals	35,159	\$9,182.86
Kings County:		
Corcoran	1,768	\$461.77
Hanford	7,028	1,835.58
Lemoore	1,399	365.39
Totals	10,195	\$2,662.74
Madera County:		
Chowchilla	847	\$221.22
Madera	4,665	1,218.41
Totals	5,512	\$1,439.63
Tulare County:		
Dinuba	2,968	\$775.18
Exeter	2,832	739.66
Lindsay	3,878	1,012.86
Porterville	5,303	1,385.04
Tulare	6,207	1,621.15
Visalia	7,263	1,896.96
Totals	28,451	\$7,430.85
Totals District VI	149,664	\$39,089.36

District VII

Los Angeles County:		
Alhambra	29,472	\$7,697.52
Arcadia	5,216	1,362.32

District VII—Continued

City	Population	Amount
Avalon		
Avalon	1,897	\$495.46
Azusa	4,808	1,255.76
Bell	7,884	2,059.15
Beverly Hills	17,429	4,552.12
Burbank	16,662	4,351.79
Claremont	2,719	710.15
Compton	12,516	3,268.94
Covina	2,786	727.65
Culver City	5,669	1,480.63
El Monte	3,479	908.65
El Segundo	3,503	914.92
Gardena	7,044	1,839.76
Glendale	62,736	16,385.44
Glendora	2,761	721.12
Hawthorne	6,596	1,722.75
Hermosa Beach	4,796	1,252.62
Huntington Park	24,591	6,422.70
Inglewood	21,421	5,594.75
La Verne	2,860	746.98
Long Beach	142,890	37,320.12
Los Angeles	1,240,575	324,014.35
Lynwood	7,323	1,912.63
Manhattan Beach	1,891	493.89
Maywood	8,426	2,200.71
Monrovia	10,890	2,844.26
Montebello	5,498	1,435.97
Monterey Park	6,406	1,673.12
Pasadena	76,362	19,944.29
Pomona	20,804	5,433.60
Redondo Beach	9,347	2,441.26
San Fernando	7,567	1,976.35
San Gabriel	7,299	1,906.36
San Marino	3,730	974.20
Santa Monica	37,146	9,701.82
Sierra Madre	3,550	927.19
Signal Hill	2,932	765.78
South Gate	19,632	5,127.50
South Pasadena	13,730	3,586.01
Torrance	8,834	2,307.27
Vernon	1,269	331.44
West Covina	997	260.40
Whittier	14,846	3,877.49
Totals	1,898,789	\$495,927.19
Orange County:		
Anaheim	11,013	\$2,876.38
Brea	2,435	635.98
Fullerton	10,860	2,836.42
Huntington Beach	3,690	963.76
Laguna Beach	1,981	517.40
La Habra	2,273	593.66
Newport Beach	2,203	575.38
Orange	8,066	2,106.68
Placentia	1,606	419.46
San Clemente	667	174.21
Santa Ana	30,322	7,919.52
Seal Beach	1,156	301.93
Tustin	926	241.86
Totals	77,198	\$20,162.64
Ventura County:		
Fillmore	2,893	\$755.60
Ojai	1,468	383.41
Oxnard	6,285	1,641.52
Santa Paula	7,452	1,946.32
Ventura	11,603	3,030.48
Totals	29,701	\$7,757.33
Totals District VII	2,005,688	\$523,847.16

(Continued on page 22)

Another Grade Crossing Peril Removed by Overpass in Bakersfield

By W. A. DOUGLAS, Associate Bridge Engineer

ELIMINATION of another hazardous grade crossing from the California Highway System was achieved on October 17 when Director of Public Works Frank W. Clark accepted the completed contract of the United Concrete Pipe Company for the construction of the Oak Street Overpass in Bakersfield.

When the Federal Government in 1935 allocated millions of dollars to the Works Program Grade Crossing

train movements constitute an additional hazard by "piling up" traffic.

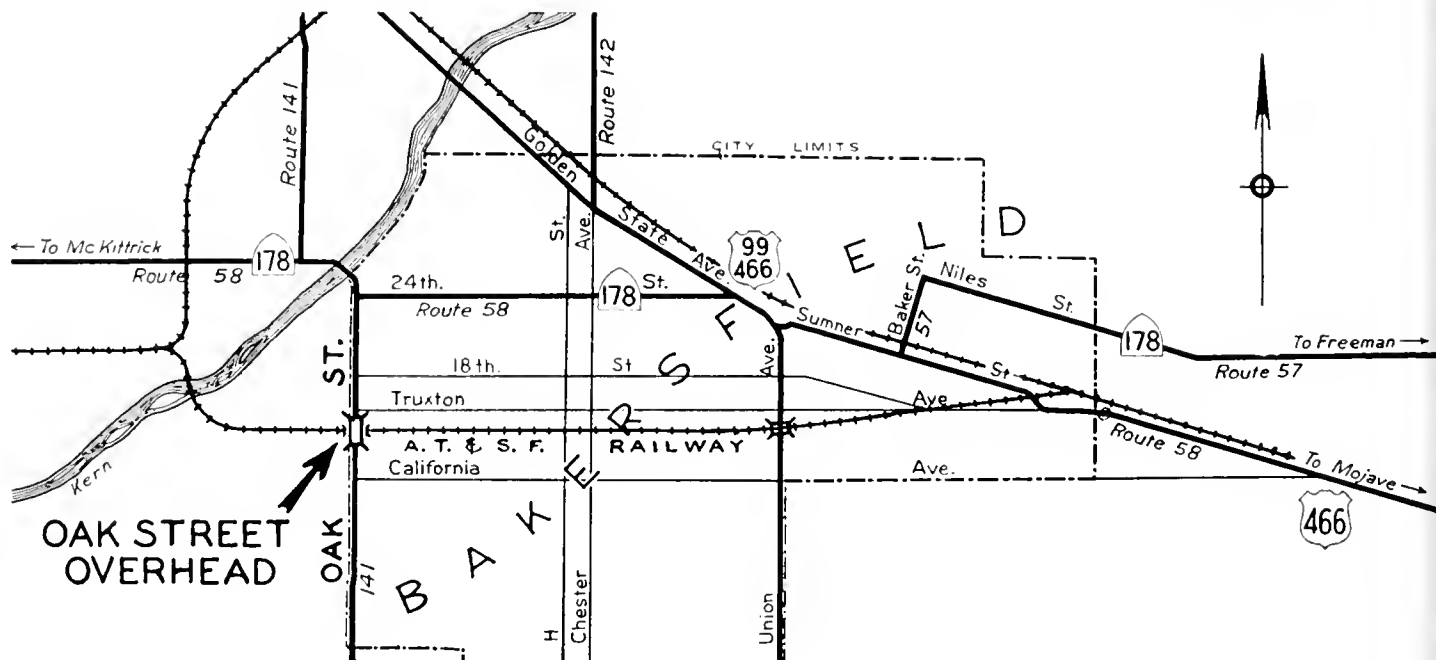
OAK STREET HAZARDS GREAT

This latter hazard is perhaps less fatal in results but nevertheless very important from a standpoint of delays and economic loss. Information from the railroad when traffic studies were being made at Oak Street in Bakersfield indicated six passenger, ten freight and 250 switching move-

Santa Fe tracks was one of the first projects considered for the Federal separation program but, due to various unavoidable delays in necessary adjustment of facilities, acquisition of right of way and requirements as to distribution of funds, was not actually financed until the 1939 allocation was programmed.

HEAVY TRAFFIC

Oak Street is the westerly city limit



funds and followed in succeeding years with additional though much lesser appropriation to the Federal Aid Grade Crossing funds, the primary prescribed objective of the program was, and is, the elimination of hazards at highway or street grade crossings of railroads.

Crossing hazards are ordinarily thought of as resulting in collision between trains and motor vehicles causing loss or damage to life and property. Crossings that are blocked to highway traffic frequently or for long periods by a large number of

movements per day. If an average of five minutes or even three minutes delay was caused highway traffic for each movement, a very large economic loss would result. The crossing record also shows that in the 13 years prior to separation, 23 accidents occurred, in which one person was killed and five injured. Therefore, it is obvious that the Oak Street project qualified for separation not only because of the existing hazards to life and limb, but also because of the frequent delays.

The separation of grades of Oak Street and The Atchison, Topeka and

its of Bakersfield. It is designated as State Highway Route 141, which connects the Golden State Highway, Route 4, on the north with a number of important local roads and highways south of the city. This route and connections form a convenient alternate route for through traffic to bypass the heavier traveled routes through Bakersfield.

The Oak Street crossing is a focal point for north or southbound traffic crossing the Santa Fe tracks west of Union Avenue. Southbound traffic

(Continued on page 26)



This grade separation structure on Oak Street in Bakersfield carries State Highway 141 over tracks of The Atchison, Topeka and Santa Fe railroad yard. It has an overall length of 1607 feet with a 26-foot roadway and sidewalks and is designed for future widening.

Cities Receive Quarterly Gas Tax Funds

(Continued from page 19)

District VIII

City	Population	Amount
Riverside County:		
Banning	2,767	\$722.69
Beaumont	1,332	347.89
Corona	7,018	1,832.97
Elsinore	1,350	352.59
Hemet	2,235	583.74
Palm Springs	2,553	666.80
Perris	763	199.28
Riverside	29,696	7,756.02
San Jacinto	1,346	351.55
Totals	49,060	\$12,813.53
San Bernardino County:		
Chino	3,118	\$814.36
Colton	8,023	2,095.45
Needles	3,144	821.15
Ontario	13,583	3,547.62
Redlands	14,177	3,702.76
Rialto	1,642	428.86
San Bernardino	39,068	10,203.81
Upland	4,713	1,230.95
Totals	87,468	\$22,844.96
Totals District VIII	136,528	\$35,658.49

District IX

Inyo County:		
Bishop	1,159	\$302.71

Mono County:
None.

District X

Amador County:		
Amador City	171	\$44.66
Jackson	2,005	523.67
Plymouth	343	89.58
Sutter Creek	1,013	264.58
Totals	3,532	\$922.49
Calaveras County:		
Angels	915	\$238.98
Mariposa County:		
Hornitos	62	\$16.19
Merced County:		
Atwater	917	\$239.50
Dos Palos	930	242.90
Gustine	1,016	265.36
Livingston	803	209.73
Los Banos	1,875	489.72
Merced	7,066	1,845.50
Totals	12,607	\$3,292.71
Sacramento County:		
Isleton	2,906	\$758.99
San Joaquin County:		
Lodi	7,382	\$1,928.04

District X—Continued

City	Population	Amount
Manteca	1,614	\$421.55
Stockton	47,963	12,527.01
Tracy	3,829	1,000.06
Totals	60,788	\$15,876.66
Solano County:		
Benicia	2,913	\$760.82
Dixon	1,000	261.18
Fairfield	1,131	295.39
Rio Vista	1,309	341.88
Suisun	905	236.37
Vacaville	1,868	487.89
Vallejo	15,277	3,990.06
Totals	24,403	\$6,373.59
Stanislaus County:		
Ceres	981	\$256.22
Modesto	14,079	3,677.16
Newman	1,269	331.44
Oakdale	2,112	551.61
Patterson	905	236.37
Riverbank	803	209.73
Turlock	4,276	1,116.81
Totals	24,425	\$6,379.34
Tuolumne County:		
Sonora	2,278	\$594.97
Totals District X	131,916	\$34,453.92

District XI

Imperial County:		
Brawley	10,439	\$2,726.47
Calexico	6,299	1,645.18
Calipatria	1,554	405.87
El Centro	8,434	2,202.80
Holtville	1,758	459.16
Imperial	1,943	507.47
Westmorland	1,476	385.50
Totals	31,903	\$8,332.45
Riverside County:		
Blythe	1,020	\$266.41
Indio	2,601	679.33
Totals	3,621	\$945.74
San Diego County:		
Chula Vista	3,869	\$1,010.51
Coronado	5,425	1,416.90
El Cajon	1,050	274.24
Escondido	3,421	893.50
La Mesa	2,513	656.35
National City	7,301	1,906.88
Oceanside	3,514	917.79
San Diego	151,694	39,619.56
Totals	178,787	\$46,695.73
Totals District XI	214,311	\$55,973.92

Auto Jobs Employ 6,380,000

Employment generated by the automobile manufacturing industry provides a livelihood for 6,380,000 per-

sons, according to the twenty-first edition of "Automobile Facts and Figures," annual publication of the Automobile Manufacturers Associa-

tion. Almost ten times as many people are employed in selling, servicing and driving as are engaged in producing them.



Official group at Kings River Canyon dedication, left to right: C. B. Morse, Assistant U. S. Regional Forester; J. E. Elliott, Superintendent Sequoia Forest; David Peckinpah, Fresno Chamber of Commerce; R. M. Gillis, State Highway Construction Engineer; M. A. Benedict, Superintendent Sierra Forest; Iener W. Nielsen, State Highway Commissioner; L. V. Campbell, Engineer City and Cooperative Projects; George McCoy, Assistant State Highway Engineer; Secretary Scott, Highway Commission; District Engineer Scott; Fred Grumm, Engineer Surveys and Plans; Highway Commissioner L. B. Hitchcock; C. C. Carleton, State Highway Attorney.

Kings River Canyon Highway Opened

(Continued from page 9)

throughout the San Joaquin Valley. Sponsors were the San Joaquin Valley Regional Council of California, State Chamber of Commerce, Fresno County

Chamber of Commerce and the Associated Chambers of Tulare County.

The speakers included State Highway Commissioner Iener W. Nielsen of Fresno; Supervisor J. E. Elliott of Sequoia National Forest, in which the canyon is situated; W. A. Collins, Chairman of the Fresno County Board of Supervisors; Chester H. Warlow of the Fresno Chamber of

Commerce; Associate State Highway Engineer George T. McCoy, representing State Highway Engineer C. H. Purcell; R. M. Gillis, State Highway Construction Engineer; C. B. Moss, Associate Regional Forester, United States Forest Service; Fred Grumm, State Highway Engineer of Plans and Surveys; and former Congressman D. S. Church of Denver

Bay Bridge Anniversary Report Shows Record Traffic and Toll Earnings

TOPPING all toll bridges in annual earnings and ranking among the first three in traffic, the San Francisco-Oakland Bay Bridge observed its third anniversary Sunday, November 12.

From the moment President Franklin D. Roosevelt pressed the "go" signal in Washington, at 12.30 o'clock noon, November 12, 1936, traffic has sped in an unceasing flow, day and night, across the 4½-mile span, piling up an enormous total of 28,650,000 vehicles in the succeeding three years.

The only toll bridges higher in traffic volume, according to 1938 totals, are the Delaware River Bridge and the Triborough in New York. The Bay Bridge topped the George Washington Bridge last year by a million vehicles.

Director of Public Works Frank W. Clark, reporting to Governor Olson, chairman of the California Toll Bridge Authority, announced

that in the period November 12, 1936, to November 12, 1939, total revenues from the bridge (including tolls paid by the interurban, rents and interest) approximated \$15,300,000.

He said the bridge now carries 78 per cent of all vehicular traffic crossing between San Francisco and Alameda counties (exclusive of Treasure Island traffic).

He pointed out that if the vehicles that have crossed by bridge and ferry since the bridge opened (34,178,300) had paid the average toll charged by the ferries (\$.078) just before the bridge opened, they would have paid a total of \$26,659,000 instead of the actual amount totaling \$16,391,000. Thus, Mr. Clark said, the bridge has effected a saving of \$10,268,000 to motorists. Tolls, he said, have been reduced by approximately one-half since pre-bridge days.

The interurban system across the bridge increased the number of persons served by the span by approximately 17,000,000 to date, bringing

the total in the last three years to an estimated 80,000,000 persons, more than 60 times the combined population of San Francisco and Alameda counties.

The expansion of commerce across San Francisco Bay since the bridge opened is also indicated in freight figures which show a forty per cent increase in the total amount of trans-bay tonnage handled, Mr. Clark said.

The bridge has handled some 2,000,000 exposition-bound vehicles, and carried almost half the number of persons going to the fair, Mr. Clark reported.

On the eve of its third anniversary, the San Francisco-Oakland Bay Bridge broke all of its previous monthly records in the amount of traffic carried in October with a total of 1,141,338 vehicles crossing during the 31-day period, making the fourth successive month in which traffic topped the million mark. Preceding months were: July, 1,093,502; August, 1,127,528; September, 1,015,824.

Turlock Overhead Nears Completion Eliminating Dangerous Grade Crossing

By W. J. DEADY, Resident Engineer

ONE of the few remaining dangerous grade crossings on Route 4 will soon be a thing of the past with the construction work on the Turlock Overhead project at the three-quarter point. With the exception of the Cherry Avenue crossing at Fresno, this will complete the program of separating the grades of the highway and main line railroad tracks on the Golden State Highway between Sacramento and Los Angeles.

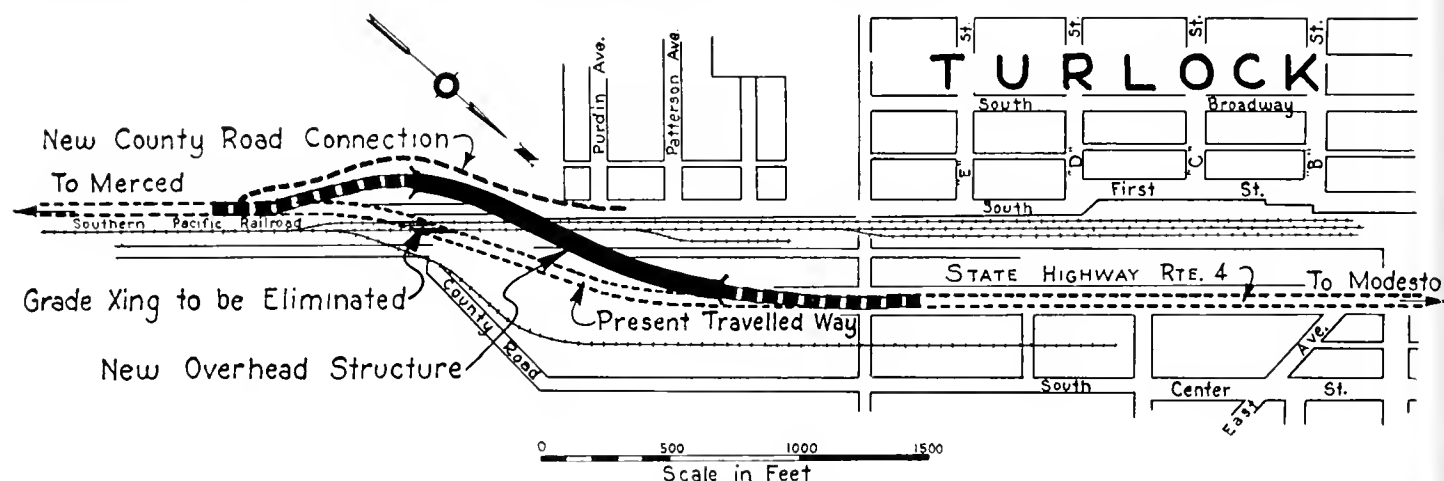
The original crossing of the Southern Pacific tracks south of Turlock was surfaced in 1913. This was a

An overhead crossing was decided upon when studies revealed that a subway would have been a difficult and costly undertaking because of the proximity of the ground waters to the surface. The design finally decided upon is a typical modern example of grace and economy.

On February 8, 1939, bids were opened and the contract was awarded to the Union Paving Company of San Francisco. The total project allotment is \$330,500 with contract items amounting to \$284,100. Excellent progress has been made by the con-

1247 feet long and will rise sufficiently high into the air to provide a 23-foot vertical clearance at the tracks. There will be 23 steel beam spans of various lengths with a reinforced concrete deck.

The composite design selected for the portion of the bridge between bents 7 and 15 is both unique and economical. Here the span lengths are controlled by the legal side clearances at the tracks and the skew angle, which is 24 degrees, 59 feet. Had the common practice of placing all of the beams parallel with center



90 degree crossing with sharp approach curves. In 1934, State Highway alignment through Turlock was greatly improved and the crossing angle was revised to 21 degrees to permit the use of longer and flatter approach curves. This improvement, however, was considered only a temporary expedient that would somewhat lessen the danger of the crossing until such time when funds could be made available for a separation of the grade. In 1938 a Federal Grade Separation Allotment made possible the construction of such a structure. The traffic count at the crossing was at that time 5600 vehicles per 16 hours. It is estimated that this has since increased by at least 10 per cent.

traeting firm and the project is approximately 30 per cent ahead of schedule.

With 75 per cent of the work complete, the project to date has provided approximately 60,000 man-hours of labor. This does not include the labor required to produce the 4500 tons of road gravel, 9000 barrels of cement, 9800 tons of sand and gravel for concrete, 690,000 pounds of reinforcing steel, 1,711,000 pounds of structural steel, 21,000 lineal feet of treated piling, together with form lumber and other materials that will go into the project. There are, in all, 100 miles of reinforcing bars in the job.

The structure will be approximately

line been followed it would have been necessary either to have raised the deck elevation and substituted plate girders for the "I" beams or increased the number of "I" beams beyond all limits of economy.

With the design adopted, a sizeable saving of steel is made by placing a number of the girders normal to the piers. These carry a large portion of the loads. The two girders on the outsides are parallel to center line and are continuous over the piers. These outside girders, which, at best, could only receive a portion of the load that is transmitted to an interior beam, are 36-inch wide flange sections weighing 300 pounds per foot. They are the

(Continued on page 28)



At top—General view of highway overhead structure under construction at Turlock separating grades of Golden State Highway and main line railroad tracks. Lower left shows unique design of placing some girders normal to the piers on skew curve. Bottom—Laying reinforcing steel on bridge deck.

Grade Crossing Peril Removed by Overpass

(Continued from page 20)

distributes to Route 4 by way of California Avenue or Brundage Lane or toward Taft and Maricopa and other points south and west. Northbound traffic distributes to the business district of Bakersfield, to the west on Route 58, to the north on Route 4, or to the oil fields easterly.

There is no other grade crossing within eleven blocks to the east as The Atchison, Topeka and Santa Fe Railroad yards make such a grade crossing impractical. It is also highly improbable that any separation would be built within the yard area as the vehicular traffic would hardly warrant it and the physical difficulties involved would make such a separation uneconomical. The area to the west is sparsely settled and outside the city limits. Therefore, a separation within a considerable distance in that direction seems unlikely.

The Oak Street Grade Crossing involved a main line, passing track and three yard tracks of The Atchison, Topeka and Santa Fe. The overhead structure recently completed provides for twelve tracks which will accommodate the ultimate development of yard facilities.

Highway traffic amounting to about 2000 vehicles per day is now accommodated by a two-lane 26-foot overpass with sidewalks for pedestrians. Since highway traffic is increasing on this route, it is anticipated that a wider roadway will be needed later. The present structure was therefore built to permit future widening. Surfaced sideroads were provided for access to abutting property where needed.

The final cost of the Oak Street Overpass is about \$190,000. It is considered an outstanding improvement, which adds very materially to the safety and convenience of highway users in the Bakersfield area. For the satisfactory planning and construction of this separation, a great deal of credit is due the city of Bakersfield and The Atchison, Topeka and Santa Fe for their cooperation.

Otto Parlier was superintendent for the contractors and Irwin T. Johnson was resident engineer for the State.

Highway Bids and Awards for the Month of October, 1939

BUTTE COUNTY—Fifteen bridges between Marysville and Chico to be strengthened. District III, Route 3, Sections B, C, A. Frederick Anderson, Oakland, \$12,376; E. E. Smith, Eureka, \$14,273; M. A. Jenkins, Sacramento, \$15,740; C. W. Caletti & Co., San Rafael, \$16,656; A. A. Tieslan, Berkeley, \$16,790; Albert H. Siemer and John Carcano, San Anselmo, \$17,605. Contract awarded to F. Kaus, Stockton, \$12,361.

FRESNO COUNTY—At Firebaugh, about 2.7 miles to be graded and surfaced with plant-mixed surfacing and bridges to be constructed. District VI, Route 41, Sections M, Firr, N. Louis Biasotti & Son, Stockton, \$142,229; Trewhitt-Shields & Fisher and Stewart & Nuss, Inc., Fresno, \$145,657; Union Paving Co., San Francisco, \$147,370; Claude C. Wood & L. D. Tonn, Lodi, \$160,178; Basich Bros., Torrance, \$163,184; United Concrete Pipe Corp., Los Angeles, \$175,149; A. S. Vinnell Co., Alhambra, \$199,087. Contract awarded to Al Teichert & Son, Inc., Sacramento, \$137,730.

INYO COUNTY—Between southerly boundary and Lone Pine, about 9.7 miles road-mix surfacing and seal coat. District IX, Route 23, Sections G, L. A. S. Vinnell Co., Alhambra, \$11,768. Contract awarded to Basich Bros., Torrance, \$10,877.40.

INYO COUNTY—Between Natural Soda Products Plant and Panamint Sink, about 12.1 miles to be surfaced with road-mix surfacing. District IX, Route 127, Sections D, E, F. A. S. Vinnell Co., Alhambra, \$17,372; Basich Bros., Torrance, \$18,408. Contract awarded to Ruddy & Corfield, Modesto, \$16,593.60.

INYO COUNTY—Ten miles southeast of Keeler, 1.1 miles grading and road-mix surface treatment. District IX, Route 127, Section D. Basich Bros., Torrance, \$5,266; A. S. Vinnell Co., Alhambra, \$6,145; Ruddy & Corfield, Modesto, \$6,925; Oilfields Trucking Co., Bakersfield, \$7,405; Rexroth & Rexroth, Bakersfield, \$7,498; Spaletta, Siri & Siri, Santa Rosa, \$12,657. Contract awarded to Anderson & France, Visalia, \$3,952.05.

KERN COUNTY—Between Weldon and Chimney Creek, imported borrow blanket and road-mix surface treatment on 1.4 miles. District IX, Route 57, Section J. A. S. Vinnell Co., Alhambra, \$7,715; Basich Bros., Torrance, \$9,252; George E. France, Colfax, \$9,221. Contract awarded to Rexroth and Rexroth, Bakersfield, \$6,980.80.

LOS ANGELES COUNTY—Between Walnut Canyon and Solstice Canyon, about 3.7 miles to be graded and plant-mixed surfacing and portland cement concrete pavement to be placed. District VII, Route 60, Section A. Parish Bros., Los Angeles, \$258,671; Matich Bros., Elsinore, \$260,711; Maceo Construction Co., Clearwater, \$263,384; J. E. Haddock, Ltd., Pasadena, \$271,612; Basich Bros., Torrance, \$278,448; Claude Fisher Co., Ltd., Los Angeles, \$281,888; Radich & Brown, Burbank, \$282,230; Griffith Co., Los Angeles, \$295,053; United Concrete Pipe Corporation, Los Angeles, \$311,235; Spicer & Thompson, Los Angeles, \$328,697. Contract awarded to John Strona, Pomona, \$245,786.80.

MERCED COUNTY—Between Merced and Black Rascal Creek, about 1.7 miles to be graded, paved with portland cement concrete and plant-mixed surfacing and reinforced concrete bridges to be constructed. District X, Route 4, Section C. Louis Biasotti & Son, Stockton, \$179,190; Union

Paving Co., San Francisco, \$186,179; United Concrete Pipe Corp., Los Angeles, \$199,276. Contract awarded to Marshall Hanrahan, Redwood City, \$175,327.95.

MONTEREY COUNTY—Between the southerly boundary and Bradley, about 7.3 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District V, Route 2, Section I. J. E. Haddock, Ltd., Pasadena, \$250,399; Eaton & Smith, San Francisco, \$279,277; Basich Bros., Torrance, \$242,361; The Utah Construction Co., San Francisco, \$235,113; R. E. Hazard & Sons, San Francisco, \$232,901; Harnus Bros. and N. M. Ball Sons, Berkeley, \$236,585; Daley Corp., San Diego, \$256,328; A. Teichert & Son, Inc., Sacramento, \$258,127; Heffey-Moore Co., Frederickson & Watson Const. Co., Oakland, \$258,885; Claude Fisher Co., Ltd., Los Angeles, \$261,879; United Concrete Pipe Corp., Los Angeles, \$227,402; Oswald Bros., Los Angeles, \$262,677; Gibbons & Reed Co., Burbank, \$288,911. Contract awarded to Hemstreet & Bell, Marysville, \$228,912.20.

SACRAMENTO COUNTY—Fenders and draw rest for bridge at Three Mile Slough about 7.4 miles north of Contra Costa County line to be constructed. District X, Route 11, Section C. Holdener Construction Co., Sacramento, \$19,033; Healy Tibbitts Construction Co., San Francisco, \$19,882; Frank Legg, San Francisco, \$20,083; M. A. Jenkins, Sacramento, \$21,717; M. B. McGowan, Inc., San Francisco, \$22,906. Contract awarded to Bundesen & Lauritzen, Pittsburg, \$17,489.70.

SAN BERNARDINO COUNTY—Between Upland and Haven Ave. and between San Bernardino and Verdemon, about 7.1 miles plant-mix surfacing to be placed and a seal coat applied thereto. District VIII, Routes 190 and 191, Sections A, S. Bd., A. Griffith Co., Los Angeles, \$32,501; E. L. Yeager, Riverside, \$34,119; J. E. Haddock, Ltd., Pasadena, \$34,524; Geo. Herz & Co., San Bernardino, \$34,963. Contract awarded to Oswald Bros., Los Angeles, \$30,993.

SAN DIEGO COUNTY—3.9 miles road-mix surface treatment through La Jolla Indian Reservation. Daley Corp., San Diego, \$14,891; Anderson & France, Visalia, \$13,855; R. M. Price, Huntington Park, \$13,878. Contract awarded to R. E. Hazard & Sons, San Diego, \$12,769.50.

SAN DIEGO COUNTY—Between El Cajon Avenue in La Mesa and Sunshine Street in El Cajon, about 4.1 miles to be graded and portions to be paved with portland cement concrete and asphalt concrete. District XI, Route 12, Sections L, Msa., B, E, Cj. Griffith Co., Los Angeles, \$224,745; R. E. Hazard & Sons, San Diego, \$239,313; Daley Corp., San Diego, \$246,552; J. E. Haddock, Ltd., Pasadena, \$283,390. Contract awarded to V. R. Dennis Construction Co., San Diego, \$219,325.45.

SAN FRANCISCO CITY AND COUNTY—Between Lake St. and Golden Gate Bridge approach, consists, in general, of about 1.6 miles to be paved with portland cement concrete on crusher run base, and a lighting system to be furnished and installed. District IV, Route 56, Section S. E. Maceo Construction Co., Clearwater, \$130,536; Chas. L. Harney, San Francisco, \$136,591; Eaton & Smith, San Francisco, \$141,754; The Fay Improvement Co., San Francisco, \$153,483. Contract awarded to Union Paving Co., San Francisco, \$130,373.50.

(Continued on page 27)

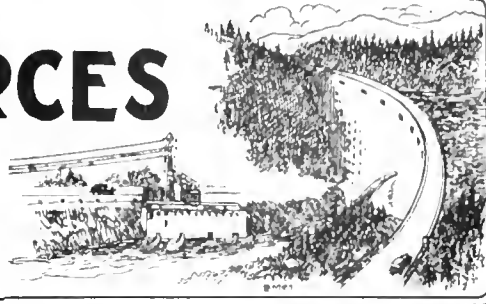
DIVISION OF WATER RESOURCES

OFFICIAL REPORT

FOR THE MONTH OF

OCTOBER, 1939

EDWARD HYATT, State Engineer



IRRIGATION DISTRICTS

Imperial Irrigation District called for bids October 3d, on miscellaneous equipment and materials for its power plant located at Drop No. 3 on the All-American Canal. Construction of the District's hydro power plants has been under way for several months and they are expected to be completed and in operation by April 1, 1940. The Imperial Dam and Headworks, and the All-American are now substantially completed. The canal is ready for priming preparatory to being placed in service.

Santa Ynez River Conservation District in Santa Barbara County was organized at a special election to protect and develop the water supplies of the Santa Ynez River. It embraces over 150,000 acres of land along that stream in Lompoc and Santa Ynez valleys.

The Irrigation Districts Association of California held its biannual meeting in San Francisco, October 19th and 20th for discussion of current problems, including flood control plans and equitable methods of collecting revenues by levying assessments or by charging water tolls. More than three hundred delegates from 47 counties were in attendance.

CENTRAL VALLEY PROJECT

Studies were continued with regard to the disposal and distribution of power which will be available from the Shasta Power Plant of the project including the programming of additional facilities to provide for the absorption thereof in the market of northern and central California, also for the formulation of a program of studies and investigation to be made in connection with the disposal of water made available by the project.

Some assistance was given the Bureau of Reclamation in negotiations with public utility companies in connection with the relocations of power and communication facilities for the completed Central Valley Project and the temporary relocations necessitated by construction activities.

Studies were made relative to the East-side Water Storage District in the Edison-Arvin Area in Kern County under organization for obtaining water from the Central Valley Project.

The annual collection of data on ground water levels in the upper San Joaquin Valley was continued during the month.

Assistance was rendered to Governor Olson's Committee on Central Valley Project.

SPECIAL INVESTIGATIONS

Flood Damage Repairs

Investigations and the preparation of reports on work for which applications have been made for allotments from the State Emergency Fund for the restoration of property, levees, flood control works, county roads and bridges damaged by the floods of the 1937-1938 winter season, were continued. No allocations were made by the Director of Finance for flood damage repairs during the month. The total amount of outstanding allocations at the end of the month was \$4,648,400. The Division of Water Resources has performed, or is performing, considerable of the work for which these allocations were made and the remainder is being done by the applicants under one hundred seventy-eight contracts entered into with the Department of Public Works. These contracts cover work which will cost \$3,652,200, much of which has already been completed. Work was continued on the checking of plans for work to be done under these contracts, supervision and inspection of the work, the checking and approval of claims for payments for work already performed and the auditing of the accounts of the various agencies prior to the making of final payments.

Flood Control Works on Napa State Farm

Work was started on the construction of the drainage channel, levees and incidental works on the Napa State Farm under an allotment from the Emergency Fund. Clearing work was practically completed and the construction of levees and drainage channels was about 50 per cent completed during the month.

FLOOD CONTROL AND RECLAMATION

Sacramento River Project

Routine maintenance work was carried on during this period, on the levees and project works in Sutter and Colusa Counties. Lower cross bracing was placed on the new bridges, constructed with flood damage repair funds, in the Sutter By-pass. This bracing could not be placed earlier on account of the height water had to be held in the borrow pits for irrigation.

Work has continued in clearing brush, poisoning squirrels and filling cracks in the levee on the left bank of the Sacramento River in Butte Basin, in Colusa County from Butte Slough to the northerly county

line. The squirrel infestation on this levee is more serious than on any other levee in the project.

The cooperative bank protection program of the State and Federal Government on the Sacramento River is proceeding satisfactorily. This office has obtained the necessary rights of way for the levee setback work in Reclamation Districts Nos. 70, 730, 900, 1500 and Sacramento River West Side Levee District.

Relief Labor Work

The work on our W.P.A. Project No. 10983 was resumed October 15th and a total of 1,056 man-hours of relief labor were utilized to October 21. On the same project from September 25th to October 21st a total of 20,851 man-hours was employed in clearing timber and brush in the American River and the Yolo By-pass.

Sacramento-San Joaquin Water Supervision

During the past months the entire efforts of the field men have been directed towards securing data relative to the acreages irrigated from the Sacramento and San Joaquin rivers and their tributaries. Salinity is almost entirely gone from the Sacramento River channels but still holds at a rather high rate in the San Joaquin River part of the Delta.

DISTRICTS SECURITIES COMMISSION

The regular monthly meeting of the Securities Commission was held October 13th in San Francisco for consideration of the following petitions, all of which were granted approval:

El Camino Irrigation District, an assessment levy of \$4,370.62; Grenada Irrigation District, an assessment of \$2,832; Montague Water Conservation District, an assessment of \$1,295.13; Waterford Irrigation District, an assessment of \$37,242.96; Tracy Clover Irrigation District, a plan for refunding outstanding bonds in the amount of \$52,170 through an R.F.C. loan of not to exceed \$20,000.

Highway Bids and Awards

(Continued from page 26)

TULARE COUNTY—In the city of Tulare, about 1.1 miles to be surfaced with plant-mixed surfacing. District VI, Routes 4, 134, Section Tul. L. A. Brisco, Arroyo Grande, \$9,200. Contract awarded to Union Paving Co., San Francisco, \$8,422.

Turlock Overhead Project Nears Completion

(Continued from page 24)

heaviest rolled shapes made. Other shorter 36-inch interior beams placed parallel to the outside girders and framed into the beams normal to the piers make up the balance of the assembly. The composite section contains beams of continuous, restrained and simply supported designs. The bearings are rollers.

On the approach spans, the beams are parallel to center line with their continuity broken in every other span by short hanging sections simply supported on the cantilever overhangs. A clear roadway width of 50 feet is provided on the deck with sidewalks on either side. The railing will be constructed of tubular steel. Slender octagonal concrete column bents or piers resting on treated timber pile foundations support the superstructure. The approaches, amounting to one third of a mile in length, are constructed of selected imported borrow and surfaced with four lanes of Portland cement concrete pavement. The pavement is bordered on either side with concrete curbs, gutters and sidewalks. Channelized plant-mixed surfaced connections to the county roads will segregate the local and through traffic.

The cost of erecting the structural steel was far below the average. A crew of thirteen men and two truck cranes unloaded and completed the erection of the 855 tons of steel in 24 working days.

Approximately 220 tons of the steel were flame cleaned in lieu of sandblasting as an experiment. The process consisted of passing an oxy-acetylene flame over the surface of the member to be cleaned. Handscrapping and wire brushing followed the application of the flame. This process has two advantages over sandblasting, namely, the removal of occluded moisture and the absence of the usual dust clouds that are common to the sandblasting operations. Results of the experiment are not yet available.

Economical and adequate form design for octagonal columns is always a problem. Wooden collars are not susceptible of ready arrangement into

In Memoriam

Andrew Milfred McCurdy

The untimely passing on October 7, 1939, abruptly terminated the career of A. W. McCurdy with the Division of Highways after twenty-two years of service.

Mr. McCurdy was born in Dansville, New York, on August 23, 1886, and, after completing grammar and high schools in that city, entered the employ of the Westinghouse Electric Manufacturing Company at Pittsburgh, Pa., in 1903. In 1904, he left there and worked with the Connecticut Railway Signal Company at Buffalo, N. Y.

In 1905, he went to Los Angeles where he entered the employ of a private engineer. After two years in this work, he entered the service of the Los Angeles County Highway Commission where he rose to Chief Draftsman and then Office Engineer.

In December of 1914, he left the employ of Los Angeles County to engage in private engineering practice until July 23, 1917, when he entered State employ as a draftsman in Headquarters Office at Sacramento. There, again, his promotion was rapid and on August 1, 1920, he was appointed Office Engineer.

On July 15, 1923, he transferred to District IV in San Francisco as Assistant Division Engineer, which title was changed in 1928 to District Office Engineer, and remained in that capacity until August 1, 1939, when he assumed jurisdiction over the newly-created District Traffic and Safety Department.

In his passing, District IV has lost an employee who, through long years of association, knew the District and the State from highway to byway, and the loss of his vast fund of highway history and experience will be keenly felt.

The entire Division of Highways extends sympathy to his widow, mother, sister, and brothers.

units, are clumsy to install and remove and expensive to make. Because of the pressures on the eight faces more or stronger collars are required for these columns than for the rectangular ones. This problem was solved by converting the octagonal shape of the outside of the form into a circle by the use of filler blocks cut to the shape of circular segments. Iron bands $\frac{1}{8}$ -inch by $1\frac{3}{4}$ -inches in size with small connection angles welded to the ends were used for collars around the filler blocks. The angles were drilled and $\frac{5}{8}$ -inch bolts were utilized to cinch the collars together.

New Divided Highway Unit Completed

(Continued from page 10)

ture is being built by J. E. Haddock Ltd., contractor, at an approximate cost of \$63,500.

The portion of the highway north of the Santa Ana River was constructed to a thirty-three foot width of traveled way and is bordered on each side with seven feet of surfaced shoulders.

After the rough grading operations were completed, twelve inches of selected material were placed on the new roadway section. Surfacing of the roadway section, including shoulders, consisted of a four-inch depth of road-mix surface treatment applied to the top portion of the selected material. This was covered with a Class "C" seal coat using screening for the traveled portion of the road and sand for the shoulders.

The recessed panel type curbs for the divisional strip were constructed with concrete from transit mixers.

Some of the major items of work on this project consisted of approximately 102,000 cubic yards of roadway excavation involving 2,500,000 station yards of overhaul; applying road-mix surface treatment to 94,000 square yards of roadway surface using 795 tons of liquid asphalt and applying a seal coat to this same area.

Many drainage structures were placed using over 2000 lineal feet of various sizes of corrugated metal pipe and 110 cubic yards of structure concrete. As most of the improvement was on new right of way, much work was performed in removing and rearranging water lines and other facilities belonging to private owners and public utilities.

This project, involving 35 contract items and an expenditure of approximately \$66,000, was completed by Matieh Bros., contractor, in the unusually short time of four months.

Mr. G. E. Malkson was the Resident Engineer.

Mrs. Newlywed—"Now, dear, what'll I get if I cook a dinner like this every day for a year?"

Mr. Newlywed—"Probably my life insurance."—*Macon Telegraph.*

State of California

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Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

FRANK W. CLARK, Director of Public Works

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Engineer

C. E. BERG, Supervising Estimator of Building Construction

DIVISION OF CONTRACTS AND RIGHTS OF WAY

C. C. CARLETON, Chief

FRANK B. DURKEE, Attorney

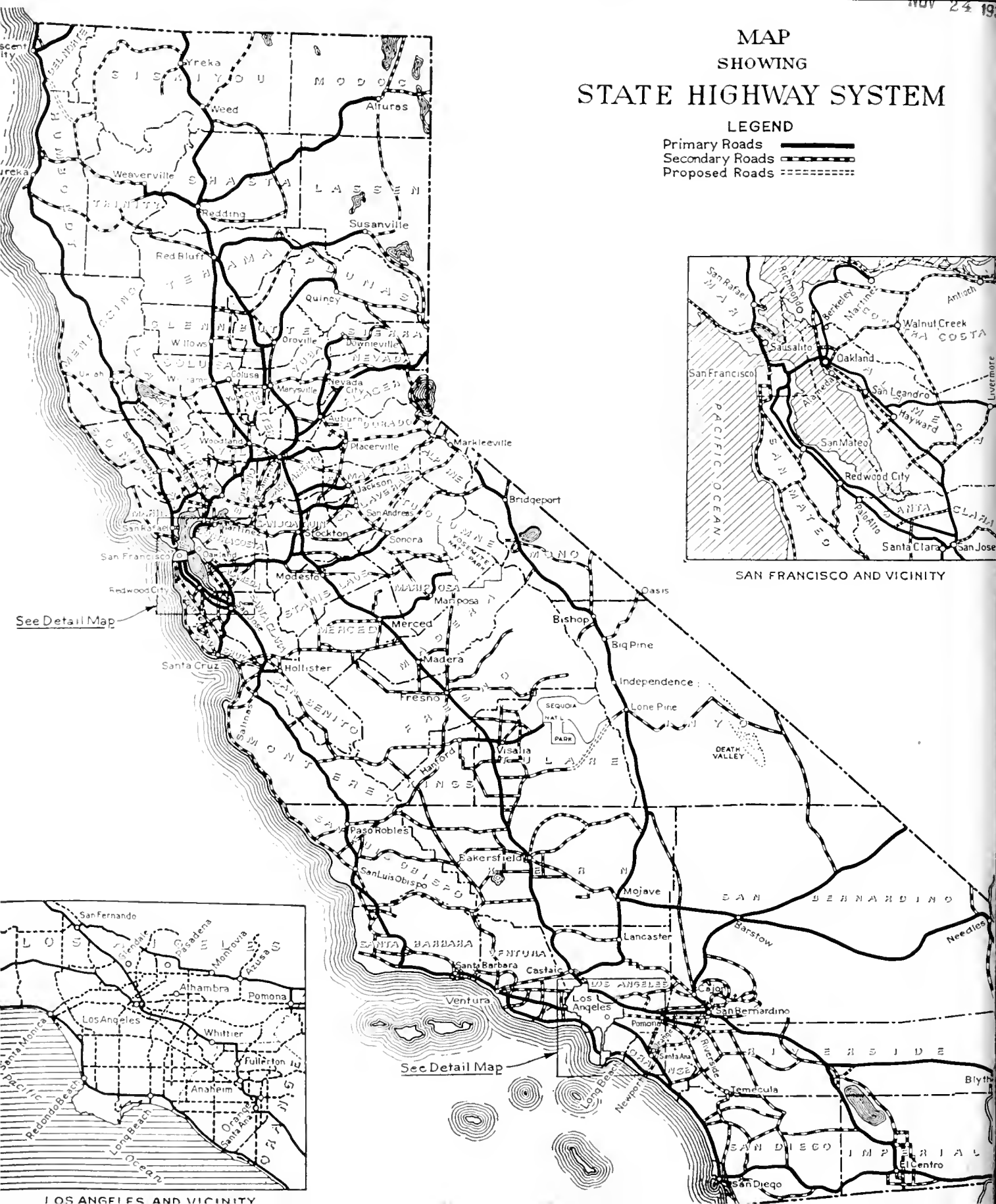
C. R. MONTGOMERY, Attorney

ROBERT E. REED, Attorney

MAP SHOWING STATE HIGHWAY SYSTEM

LEGEND

- Primary Roads —————
- Secondary Roads - - - - -
- Proposed Roads



See Detail Map

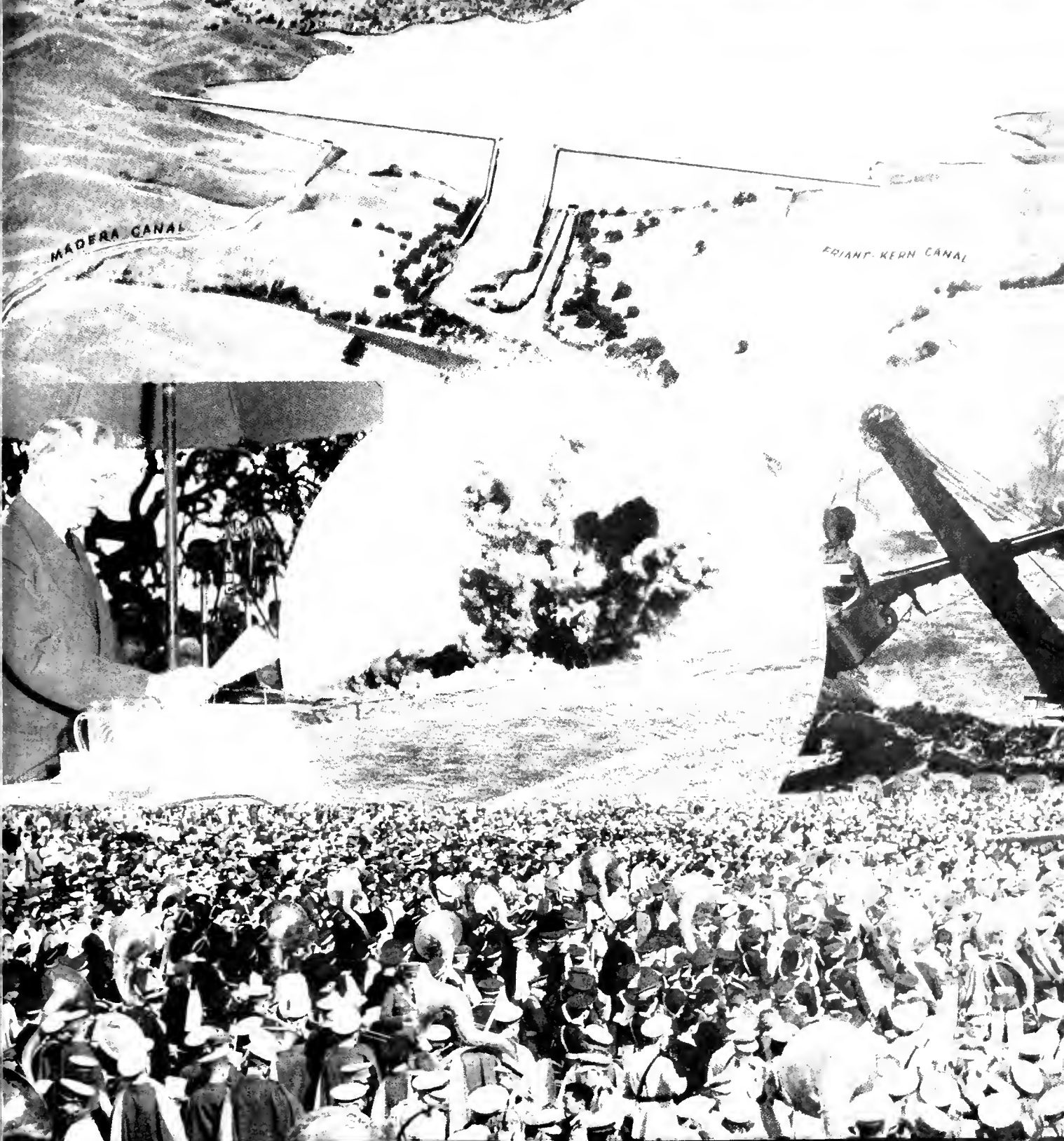
SAN FRANCISCO AND VICINITY

See Detail Map

LOS ANGELES AND VICINITY

CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



FRIANT DAM, UNIT OF CENTRAL VALLEY PROJECT, AS IT WILL APPEAR WHEN CONSTRUCTED AND SCENES AT EXPLOSION GROUND BREAKING, WITH GOVERNOR CULBERT L. OLSON ADDRESSING 30,000 SPECTATORS.

DECEMBER
1939

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

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Survey Shows Contracts for \$75,000,000 Awarded to Date on Central Valley Project

NOT since the beginning of construction work on the Central Valley Project has state-wide interest in its progress been brought into sharper focus than on November 5th when Secretary of the Interior Harold L. Ickes, Governor Culbert L. Olson, Commissioner of Reclamation John C. Page and numerous other State and Federal officials took part in the ground breaking ceremony at Friant Dam Site.

The ceremony marked the beginning of construction on the \$16,000,000 Friant Dam, key storage unit of the Central Valley Project in the San Joaquin Valley, on the San Joaquin River twenty miles north of Fresno. When completed this dam will furnish a supplemental water supply to approximately 1,500,000 acres of land in the southern San Joaquin Valley and complement the development at Shasta Dam.

Estimates of the crowd that attended the ceremony ranged from thirty to fifty thousand people and many thousands more listened to a nation-wide broadcast in which Governor Olson and Commissioner Page urged the people of California to take immediate action on developing a comprehensive program of public distribution of the electric energy which will be developed by the project.

Governor Olson told the thousands listening of the plans of his administration to make every effort to secure the passage of legislation which will assist in the public distribution of power and stressed the need for the formation of public districts so the electricity as well as the water can be handled co-operatively and at a minimum cost to the future consumers.

"The degree of success of the

Public Ownership Imperative Says Governor Olson

It is my firm conviction that the lowest costs for the major benefits of the Central Valley Project can be realized only under a comprehensive system of Public Ownership. Public ownership of every phase of the conservation, diversion, storage and distribution of water; public ownership of every phase of the generation and distribution of electric power.

Your state administration has made, and will continue to make, every possible effort to secure passage of legislation enabling and facilitating public ownership. This will make easier the formation of public utility districts and other cooperative enterprises whereby the farming communities of the Sacramento and the San Joaquin Valleys can ensure getting Central Valley water and Central Valley power at the lowest possible costs.

As is now well known, these lowest costs are not possible under private ownership and exploitation so long as the rate payer has to support: the inflated valuations of utility properties now enjoyed by the private utility companies; their capitalization of the right to exploit the rate payer as a valuable intangible asset; the high interest rates these companies pay for their borrowed capital; the high charges for so-called expert management paid by the private utility companies to their parent holding companies; and the very comfortable dividends these companies pay to their stockholders, most of whom live well removed from these valleys.

The farmer's margin of profit has become so very narrow that he can no longer afford the luxury of the private ownership of his water and power utilities.

From address at Friant Dam Ground-breaking by Governor Culbert L. Olson.

Central Valley Project; the final measure of the benefits realized from it by the farmers, will depend upon the cooperation of the communities comprised by the Central Valley," Governor Olson said.

"It is my firm conviction that the lowest costs for the major benefits of the project can be realized only under a comprehensive system of public ownership."

Voicing the same sentiment, Commissioner Page declared:

"It always has been the policy of the Bureau of Reclamation to give preference, in the disposal of power, to public agencies. It is hoped that public outlets will be available for Shasta power. This presents a big opportunity for local and State assistance to the Central Valley Project.

"Possibly new State legislation may be found desirable. I should look with favor upon some legislation, drafted with consideration for the interests of all those involved, which would enable the State, through the existing Water Project Authority, to function in relation to the project in any capacity found mutually desirable by the State and Federal governments."

The State and Federal governments, through Public Works Director Frank W. Clark and Commissioner Page, are working out details which will facilitate the State's participation in this distribution program.

Thus the State and Federal governments have moved a step nearer the solution of the problem of ultimate distribution of the water and power to be developed by the Central Valley Project on which the Federal Government through the United States Bureau of Reclamation is spending \$170,000,000.

As the year end approaches work is going forward on so many features of the project and announcements of work that will be done in the near future are coming out with such rapidity a general review of just what is taking place on the entire project is in order.

Since work was first started on a Reclamation Bureau warehouse at Friant, February 19, 1937, the Federal Government has awarded contracts totalling approximately \$75,000,000. Because of the nature of many of these contracts in which the government agrees to furnish materials, the Federal obligation is far in excess of the amount actually under contract.

The largest single contract let on the project was to Pacific Constructors, Inc., for the excavation and concrete work on Shasta Dam, which is the major unit of the Central Valley Project. The contract was for \$35,939,450 and includes the excavation work and building of the dam and power house exclusive of materials and machinery, which will probably cost as much again as this contract.

In a little over a year, Pacific Constructors, Inc., have cut and blasted

away more than 3,000,000 cubic yards of rock and earth from the sides of the Sacramento River Canyon 12 miles north of Redding. Less than 800,000 yards of earth remain to be excavated before the grooves cut into the sides of the canyon are down to the foundation rock on which the dam will be anchored.

Next spring, sometime in March, it is anticipated the actual laying of concrete will be started. The government already has awarded to the Permanente Corporation of Oakland a contract of \$6,902,000 for the cement and a contract of \$4,413,520 to the Columbia Construction Company of Oakland for the aggregates which will go into the dam.

The subcontracts alone awarded for the transportation of aggregates and the equipment for placement of concrete amount to no inconsiderable figure. Aggregates will be transported from pits near Redding over a conveyor belt system, which will be the longest ever constructed, 9.6 miles long which is being built by the Goodyear Tire and Rubber Company at a cost of \$1,500,000.

Placement of the concrete will be through a cableway system extending

from a head tower that will be 610 feet high from foundation to the airplane beacon on its tip. This tower and three tail towers are being built by the American Bridge Company. Four other tail towers, veterans of construction work at Boulder and Parker Dams are now being assembled.

In all, seven cableway systems will be installed leading from the head tower to the various movable tail towers. About 13,000 feet of three-inch locked coil cable will form a web between these towers over which the crawling cable buckets can cover every part of the dam site.

Pacific Constructors, Inc., also are building the gigantic power house at Shasta Dam which will be the largest single hydroelectric development in the State. However, the United States Bureau of Reclamation has placed a separate contract for the construction of turbines and four generators which will develop 1,500,000 kilowatts of electric energy annually. This contract is for \$4,455,527.

Yet to be built is the 200 mile long high power transmission line which will carry this power from the dam down to load center at a sub-station



View of Friant Dam site looking across San Joaquin River toward right abutment. White lines indicate excavation area for dam foundations.



Group picture taken at Friant Dam groundbreaking. Left to right, Frank W. Clark, State Director of Public Works; H. L. Ickes, Secretary of Interior; Governor Culbert L. Olson.

proposed to be built at Antioch. Already completed is the by-pass tunnel under the north abutment of the dam through which the Southern Pacific Company now routes its trains. Built at a cost of \$426,475, it will serve to divert water around the dam construction when the new railroad relocation is completed and eventually will be plugged with cement.

Other smaller contracts for warehouses and incidentals amount to \$190,000 and the government has spent \$777,727 in preliminary work and on its own camp at Shasta Dam and Friant Dam.

But in addition to Shasta Dam itself, the water to be stored in the reservoir behind it will cover up a railroad and highway system necessitating a major rebuilding program there.

The contract for relocation of thirty-five miles of Southern Pacific Railway through the reservoir site, on which work is now well under way, calls for an expenditure of \$8,213,206. This does not include materials such as rails and structural steel nor the

work which will be done on the Pit River Bridge, which will carry both rail and highway traffic across the Pit River Canyon at an elevation of 500 feet above the river bed. This will be the highest construction railroad and highway bridge in the world.

Substructure contracts for work on this bridge already have been awarded totalling \$1,138,288 and bids on the steel superstructure will be opened in Sacramento on January 16, 1940. The contract will call for the furnishing and erecting of 33,000,000 pounds of structural steel, 1,000,000 pounds of cast steel, and the placing of 1,300,000 pounds of reinforcement bars.

Nearly twenty miles of the Pacific Highway also must be relocated to an elevation above the high-water level of the reservoir and will involve a cost of approximately \$3,200,000, not including the State's share in the Pit River Bridge. Contracts for carrying out this work were signed only a month ago between the State and Federal governments.

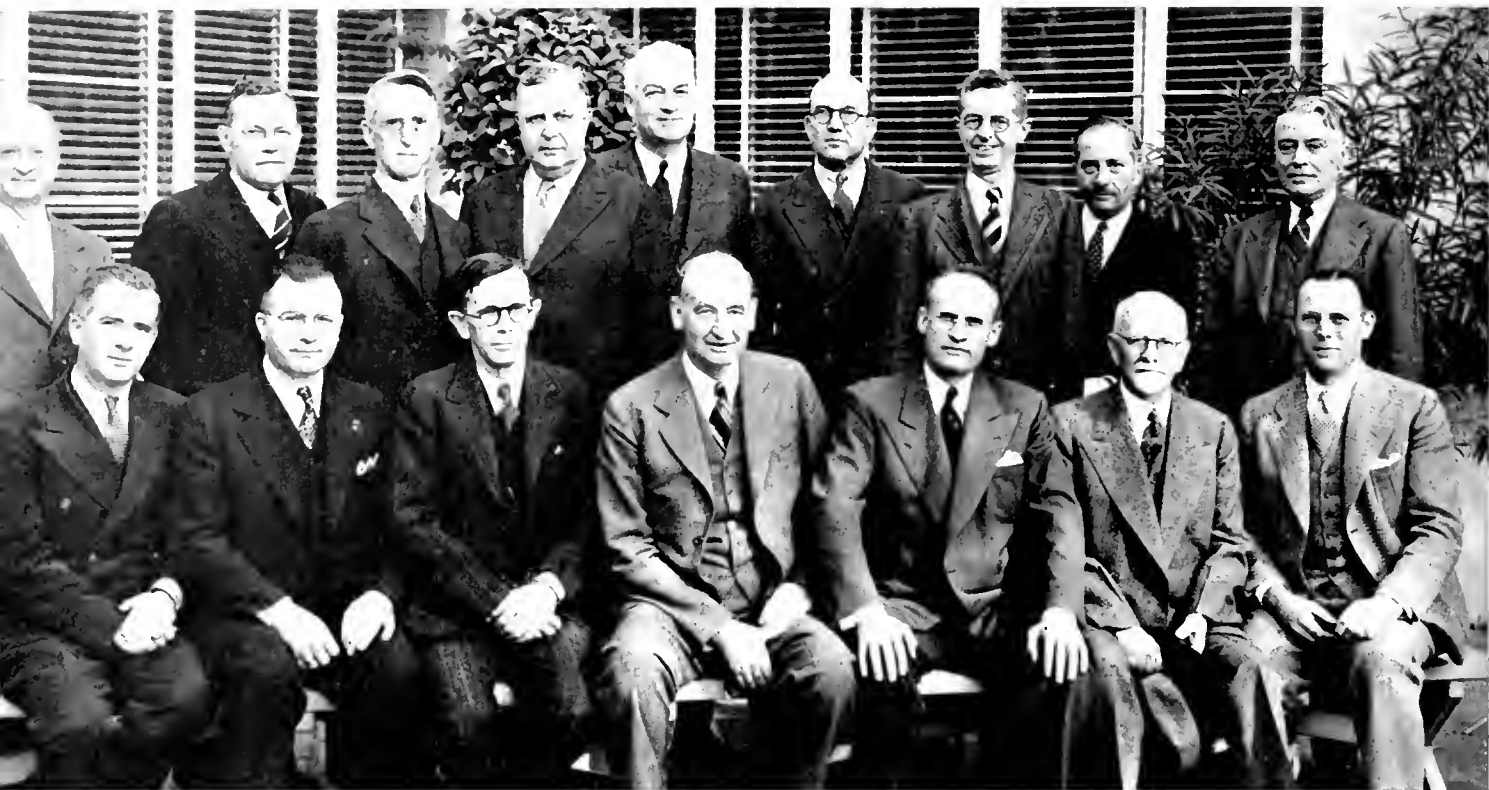
The present channel of the Sacra-

mento River will be used to carry the water stored in Shasta Dam down to the Delta region. By regulating the flow of that river, it is anticipated flood dangers will be checked during the winter months and an adequate irrigation supply provided at all times during the summer months.

This surplus flow during the low-water months of the summer, in addition to enhancing the navigability of the Sacramento River, will serve to flush from the Delta region the salt water which annually threatens the rich farming lands in that district.

Nearest completed of all the units of the Central Valley Project is the Contra Costa Conduit which extends from the Delta region at Rock Slough to a point near Martinez. Contracts totalling \$1,318,428 have been awarded on this work and it is now more than half completed.

Bids were opened in Sacramento December 12th for the construction of the head works, intake, fish screen, the cutting through work which will join the already built sections of the conduit with Rock Slough and for



Members of Governor Olson's Central Valley Project Committee—Seated, left to right, Ray Eberhard; Senator J. C. Garrison; State Engineer Edward Hyatt; former Senator Herbert C. Jones; Director Frank W. Clark of the Public Works Department; Franklin Hichborn; J. C. Youngberg. Standing, left to right, Louis Bartlett; Frank R. Chilton; E. A. Crocker; A. D. Edmonston, Deputy State Engineer; Leo J. Smith; E. A. Rolison; Paul A. McCarthy; J. Rupert Mason and C. C. Carleton, Chief, Division of Contracts and Rights of Way.

a small cut-off dam across Dutch Slough which is designed to prevent salt water encroachment into Rock Slough.

In the Delta Division of the project announcement has been made of the final location of the San Joaquin pumping system and canal which will carry 3000 second feet of fresh delta water up the San Joaquin Valley to Mendota where it will be returned to the San Joaquin River.

As now outlined, the canal will start near Stockton and through a series of pumping plants the water will be lifted 160 feet up to a high-line canal which will follow the foothills around the west side of the San Joaquin Valley.

At Mendota, more than 100 miles up stream from where it originated, it will empty into the San Joaquin River to replace the water that will be stored behind Friant Dam. Through this exchange of water about 1,500,000 acre-feet of new and vitally needed water will be supplied to lands that now have deficient supplies in the South San Joaquin Valley.

Contract for the construction of Friant Dam was let to the Griffith

Company and Bent Company, joint low bidders, for \$8,715,358. The government will supply cement aggregates, structural and reinforcing steel, pipe and machinery. Already the company has about 400 men employed in preliminary stripping operations and the construction of a camp.

Friant Dam, while smaller than Shasta Dam, still will rate as fifth largest of this type in the United States and its construction calls for the excavation of 770,000 cubic yards of earth and rock; stripping of 600,000 yards of overburden from the sand and gravel deposit; handling of 3,220,000 tons of sand and gravel; manufacture and placement of 1,850,000 cubic yards of concrete in the dam and 57,000 cubic yards of concrete in appurtenant structures; installation of 3,300,000 pounds of reinforcement bars, about 3,800,000 pounds of gates and valves, 3,440,000 pounds of tubing and fittings and 3,000,000 pounds of pipe and miscellaneous metal work.

When completed the dam will be 300 feet high and 3450 feet long and the reservoir behind it will be approximately 15 miles long. Leading from

the dam will be two canals, the Madera Canal and Friant-Kern Canal.

The Madera will extend northward 40 miles to the Chowchilla River and supply parts of Fresno and Madera County with water. Bids will be opened for the first unit of this canal in Sacramento December 21. The canal will have an initial capacity of 1000 second feet.

Surveys still are under way on the final location of the Friant-Kern Canal which will extend southward from the dam for 160 miles to a point near Bakersfield. This canal will have an initial capacity of 3500 second feet, and will be a veritable river diverted to a section where many thousands of acres have been abandoned because of lack of water.

In short, the Federal Government's construction program on the Central Valley Project now covers the entire Central Valley. Walker R. Young, supervising engineer in charge of field activities for the Bureau of Reclamation, estimates 3000 people are working on the project and the Federal Government is spending \$44 every minute of each twenty-four hours in California.

Holiday Greetings

From FRANK W. CLARK, Director
To All the Employees of the
Department of Public Works

AS THE FIRST YEAR of Governor Culbert L. Olson's administration nears its close it seems appropriate for me, as Director of Public Works, to extend through our official journal cordial holiday greetings to all who have contributed toward the successful conduct of the activities of the Department of Public Works during 1939. ¶ I deeply appreciate the fidelity of the personnel of the Department in making possible the many accomplishments in State highway and State building construction and the development and protection of the water and power resources of the State during the year now nearly gone. ¶ With full appreciation on my part of all the good work of the past, I desire particularly to stress at this time that the coming year offers opportunity for still greater effective public service. In a large organization such as ours, success, of course, depends upon a loyal, resourceful and enthusiastic group of co-workers. ¶ In any organization there is a tendency upon the part of those filling the more subordinate positions to remain silent even when they could make constructive suggestions and possibly criticism which would be most helpful to the work. ¶ I am certain this particularly applies in all departments of State service. During my several years of executive experience in private business I have seen the value of the "Employee Suggestion System" well demonstrated. ¶ If through this medium private business can be benefited, I see no reason why it would not benefit the public's business. ¶ In view of the fact that it seems quite impossible for all the employees of the Department to meet with me personally, although I would appreciate the opportunity, I am adopting this method of obtaining your ideas. ¶ Therefore, during the year 1940, in order to make our joint endeavors even more worthwhile than ever before, I invite every employee of the Department, regardless of rank, to forward to me personally any sincere suggestion, criticism or comment of any nature that he or she has to offer and believes will result in greater efficiency. ¶ May the Christmas season and the New Year bring happiness to you and yours and with it still greater opportunity to help build and maintain and further expand those facilities, which the Department of Public Works is established to provide for the convenience, safety, and enjoyment of the People.

Frank W. Clark

Traffic Far Outpaces Construction on California Highway System

By FRANK W. CLARK, Director of Public Works

Address Delivered by Director Clark at the Meeting of the State-Wide and Regional Highway Committees of the California State Chamber of Commerce at the Palace Hotel in San Francisco Thursday Morning, November 30, 1939.

YOU are business men, and I am here to talk business, a business that we are in together—you, the motoring public and your State government. It is a billion dollar concern.

California motorists contribute millions in gas tax moneys and motor vehicle fees annually for construction and maintenance of the State Highway System. They are justifiably proud of this system, comprising approximately fourteen thousand miles of good roads and representing an investment for construction and reconstruction alone of some four hundred million dollars.

The State Highway System, of which about one thousand miles are within incorporated cities, serves desert areas where the annual rainfall is less than one inch and coast areas where the rainfall is one hundred inches. It extends from a point below sea level, crossing and recrossing the Sierra Nevada Mountains to elevations of four thousand to ten thousand feet, where the average annual snowfall is 480 inches.

LACK OF FUNDS

California's far flung network of highways has been built with money willingly contributed by the people through bond issues, the gasoline tax and motor vehicle fees, and with Federal Aid moneys.

The main problem of the Highway Division can be simply stated; not so easily solved. We have a lot of work that needs to be done but we do not have the necessary money with which to do it.

The building of the present State Highway System was begun in July, 1912, following approval of an eight-million dollar bond issue in 1909.

Subsequent bond issues of 1915 and 1919 provided \$15,000,000 and \$40,000,000, respectively, for further development, making the total bond issue appropriation for highways \$73,000,000.

In 1913 the first act requiring registration of all motor vehicles was passed by the legislature, the net revenue derived therefrom being divided equally between the State and counties for road purposes. In 1923 the State adopted a two-cent gasoline tax and in 1927 increased the tax to three cents.

ROAD REQUESTS EXCEED REVENUES

In addition to the gasoline tax, the State receives thirty-one and three-fourths per cent of the motor vehicle registration and weight fees as well as certain moneys from the Federal Government for Federal Aid highways, the estimate for this biennium being \$8,000,000.

This all totals up to approximately \$28,000,000 for this biennium for construction purposes.

One-half of this must be spent in the southern thirteen counties and the other half in the northern forty-five counties. This must again be divided one-half for Primary State Highways and one-half for Secondary.

I said that we have a lot of work that needs to be done but that we do not have the necessary money with which to do it.

When the Highway Commission of the previous administration was preparing the biennial budget under which we now are operating, it received requests from counties, cities, civic organizations and other groups for highway projects totaling more than 150 million dollars.

Those projects were carefully considered by the groups presenting

them before they were submitted for approval. They were considered as number one projects in the localities affected. The present Highway Commission, since it took office on March 1, 1939, has listened to many delegations pleading for relief on their traffic problems. They have individually and collectively toured the State to view these projects at first hand and discuss the problems on the ground with civic-minded people of the many communities of our State. Most of these projects are meritorious, many of them almost emergency situations. The division recognizes the need and has the desire but I do not have to point out to you that 28 million dollars of available funds can not provide for 150 million dollars worth of requested highway work. A similar problem will confront the present Highway Commission when it prepares its budget for the next biennial period.

COOPERATION DESIRED

There are some men in Los Angeles who profess to know how to get something for nothing, but Governor Olson and the men charged with the responsibility of administering the affairs of the State and of the Highway Department, in common with a majority of the voters of California, simply could not accept their novel theories of high finance—nor could you.

We are intent on spending the money provided by law in such a manner as to give to the taxpayers and to the traveling public a dollar's worth of service for every dollar collected and spent. That is our duty—our job. That is what we will try to do—with your assistance and cooperation.

I have gone into this so carefully,

not for the pleasure of reciting figures, but in the hope that you will familiarize yourself with these facts and assist the State Highway Department by passing the information on to others who may not know these things. After all, you and I are, or should be, agreed on at least one thing: the orderly improvement and maintenance of our State Highway System so that it will not only be something that we can be proud of but will serve the increasing needs of our traveling public.

That is a large order.

At the inception of the State Highway System in 1909 the legislature provided for 3082 miles and extensions added by the second and third bond issues increased this to 5,660 miles. Additions between 1920 and 1931 brought the mileage to 7332. In 1933 about 6700 miles of county roads were added to the State's system, with no additional funds being provided for their maintenance and betterment. Today there are approximately 14,000 miles of State highways, of which about 12,869 are rural roads. More than 10,400 miles of the State Highway System are hard pavement or bituminous treated rock surface.

TRAFFIC OUTPACES CONSTRUCTION

During the 27 years since ground was broken for the first road contract, highway construction standards have made phenomenal and at the same time costly advances. In the early days 15-foot pavements were standard—today two-lane pavements are 22 feet wide, allowing 11 feet for each lane; three-lane pavements are 33 feet wide and on four-lane pavements each traffic way is 23 feet wide.

California today stands at a critical juncture in the development of highways and highway transportation. When we began building a highway system for a small but rapidly increasing number of motor vehicles, we could not perceive the ultimate extent to which that traffic would grow. In the construction of roads and highways, we have not been able to keep pace with the rapid increase in motor vehicle traffic and the steadily growing demand of our agricultural, commercial, transportation and industrial interests for more and better highway facilities. The volume of traffic in California has always been ahead of the road facilities available and funds provided for the purpose.

Twenty-five years ago there were 77,000 motor vehicles in California.

Gas Tax is Divided

There is a widespread public impression that the Division of Highways receives all of the revenue from the three-cent gas tax. The State collects a three-cent per gallon tax on the gasoline you buy. Of this, one cent is allocated directly to the counties of the State in accordance with the number of motor vehicles registered in each county. The minimum payment to each county, however, being \$30,000 per year. This money is used by the counties on county roads.

Of the remaining two cents, the revenue from one-half cent must be expended within cities, one-half of it on State highways within the city and the other half on streets of major importance. This money may be spent on maintenance or construction.

This leaves one and one-half cents to the Division of Highways. It takes about three-quarters of a cent for administration and maintenance. The remaining three-quarters of a cent is what is left for construction projects.

Excerpt from address by Public Works Director Clark.

As of last October 31, there were 2,716,277 registered vehicles. This bare statement conveys no adequate idea of the basic changes in highway design made necessary by this increase.

BUILDING TEN YEARS BEHIND

It is true that we have splendid highways that are far above the standard of other States; nevertheless we are ten years behind in our construction program. Obsolescence, inadequacy, and depreciation render at least half of the 14,000 miles of the highway system of the State incapable of safely and satisfactorily serving the traffic that they now bear.

There is probably no other public service from which the people derive such direct benefit as they do from good roads, which are so closely interwoven with our ordinary life that few

of us really appreciate their importance except when such service is interrupted or inadequate. It is a matter of simple arithmetic that taken as a whole the California Highway System has saved money to the State on a basis of comparison of vehicle operating costs alone, to say nothing of the many other economic benefits.

It is estimated that the average motorist in California pays less than two mills per mile for the benefit of using the highway system.

Today, with a highway system comprising some 14,000 miles, of which 4000 miles are unimproved and approximately 6000 more miles inadequate for the traffic carried, it is vitally essential that all funds available now and for years to come from the gasoline tax and motor vehicle fees be devoted exclusively to the purpose for which they are intended; namely, highway construction and maintenance.

It must be recognized that adoption of higher standards of construction—the expansion of lane widths, the divided type of roadway, the increased width of right of way necessary for this type of construction, and the improvement of our intersections—will further complicate the already acute financial problem.

MANY MILLIONS NEEDED

I will not attempt to go into detail as to specific improvements needed on our highway system. Mr. Purcell, our State Highway Engineer; Mr. Panhorst, our Bridge Engineer; Mr. Dennis, our Maintenance Engineer; and Mr. Grumm, Engineer of Surveys and Plans, will inform you fully in this regard. However, without infringing upon the subjects to which they will address themselves, I may say that our engineers have estimated that with the present annual revenue of the Division of Highways it will require twenty-five years and 503 million dollars for improvement and reconstruction of the State Highway System exclusive of right of way. Replacement of the rural State Highway System alone due to obsolescence and depreciation is falling behind at the rate of 151 miles of road surface and 38 bridges each year.

Our State-wide Planning Survey, in cooperation with the U. S. Bureau of Roads, has shown that 60 per cent of the traffic on the rural State Highway System originates in the

(Continued on page 16)

Monterey Realignment Involves New Bridge and Channel Change

By L. E. McDOUGAL, District Office Engineer

E L I M I N A T I O N of one of the last sections of the old fifteen-foot concrete pavement laid in District V in 1919 and 1922 will be accomplished under a contract awarded by Director of Public Works Frank W. Clark for construction of 7.3 miles of highway extending from the southern border of Monterey County, about 3.8 miles north of the town of San Miguel, to the town of Bradley.

The project involved is on the Coast Highway (U. S. 101), known as El Camino Real, between San Francisco and Los Angeles. It will include

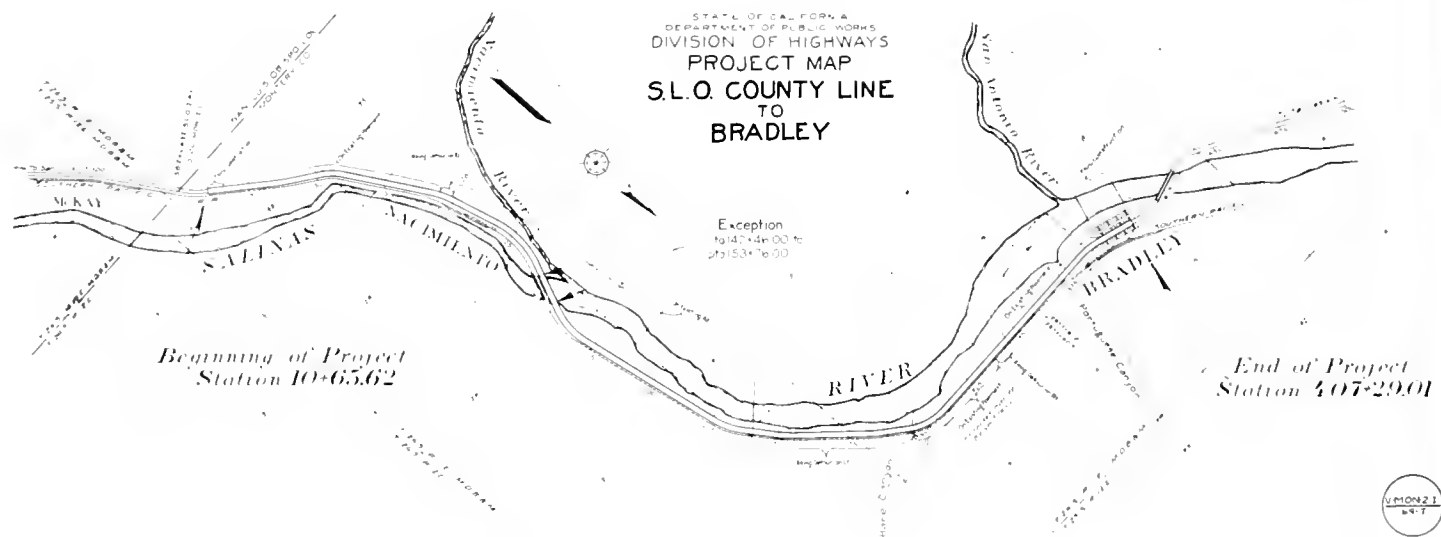
The new alignment, generally, parallels the old highway and the Southern Pacific Railroad right of way throughout its entire length.

WILL MOVE RIVER CHANNEL

The centerline of improvement generally is about 70 feet from the railroad's nearest right of way line, which will permit widening on the railroad side when traffic warrants the construction of further traffic lanes.

Due to the changes in grade and alignment and the necessity for rais-

ment most of the 7.3 miles. At two or three places it will be necessary to construct a detour road, but the total length of such detour road will not exceed 1½ miles. One of these locations will be at a point where the Salinas River has gradually eaten into the bank very close to the present highway and, at that point, the construction centerline is located nearer the railroad. At this location it is proposed to build up the river bank and throw the channel further away from the highway by the installation of 155 jack straws made with 40-pound



under a separate contract the building of a new bridge across the Salinas River near the mouth of the Nacimiento River.

The narrow original pavement has withstood heavy traffic for twenty years although for the past several years maintenance costs have been high and it has been impossible to hold the surface to a smooth riding condition. In 1929 two and one-half-foot rock borders were placed on each side of the pavement, which gave virtually a 20-foot width of traveling surface.

ing grade in places where present grade is entirely too low with respect to the adjacent lands, it was found that there would be a comparatively small portion of this 7.3 miles which could be second-storied. Also, as there were no detour roads available, it would have been necessary to construct a detour practically throughout the length of the project had the centerline followed more closely the existing pavement.

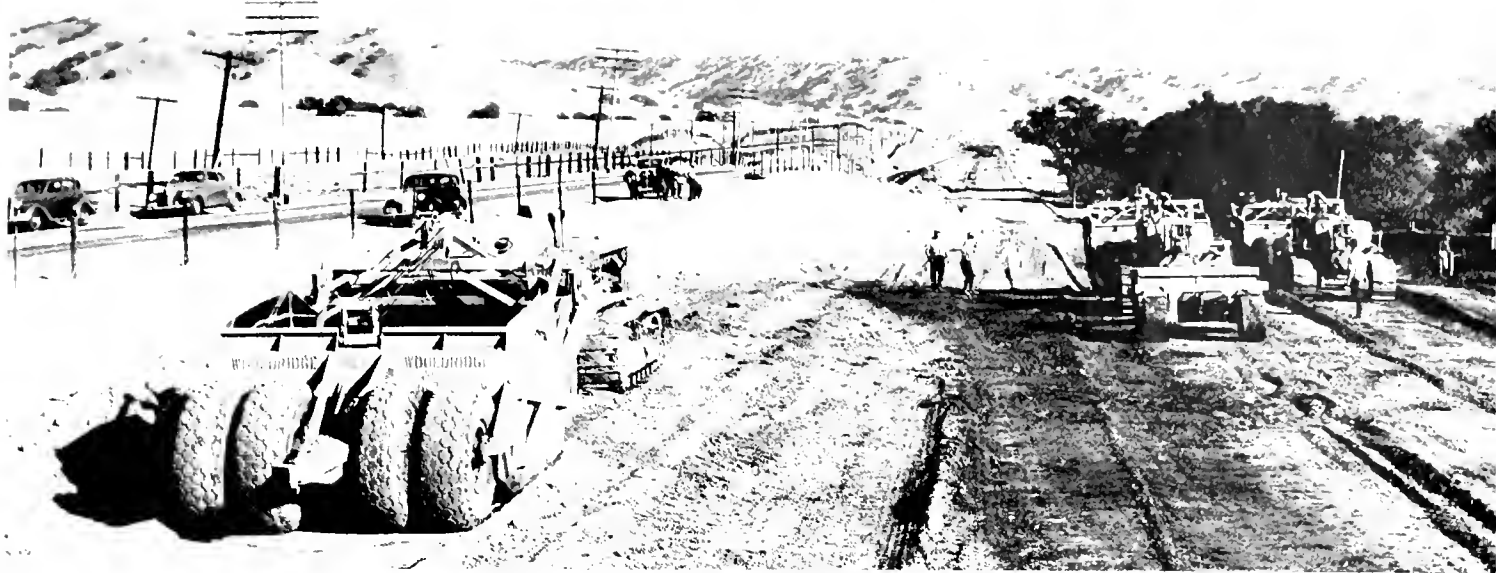
The centerline was therefore shifted over further from the railroad so that traffic may be carried on the old pave-

ment most of the 7.3 miles. At two or three places it will be necessary to construct a detour road, but the total length of such detour road will not exceed 1½ miles. One of these locations will be at a point where the Salinas River has gradually eaten into the bank very close to the present highway and, at that point, the construction centerline is located nearer the railroad. At this location it is proposed to build up the river bank and throw the channel further away from the highway by the installation of 155 jack straws made with 40-pound

ROADBED 40 FEET WIDE

This new highway will have a blanket of select material or imported borrow 6 inches thick practically throughout its entire length and generally for the full width of the roadbed, 38 to 40 feet.

(Continued on page 21)



Construction scenes on realignment of U. S. 101 near Bradley, Monterey County, showing tractor and 28 cubic yard scrapers at work.
Center—Narrow old bridge across Salinas River to be replaced and section of existing 15-foot concrete pavement laid in 1919.

Narrow Kingsburg Bridge Will Be Part of New Four-Lane Highway

By C. L. SWEET, Resident Engineer

TWO miles south of Kingsburg in Fresno County, U. S. Highway 99 crosses the Kings River on a reinforced concrete through girder bridge 950 feet long and with a 21-foot roadway. This obsolete structure, the last remaining bridge on this important highway between Sacramento and Los Angeles with such a narrow roadway, is to be part of a new four-lane divided highway. Construction work on a new span now is under way and should be completed about March 1 of next year.

On account of the high speeds and heavy traffic using this highway its narrow width forms a definite hazard and on account of the length of the structure it acts as a bottle neck at times of heavy traffic.

The through girder type of con-

struction makes it impossible to widen the existing bridge. It is in fair structural shape and, except for width, could adequately serve traffic for several years to come. It was built in 1915 by Tulare County.

The budget for the 89-90th fiscal years set up \$180,000 for the construction of a new bridge and approaches at this location. After studies of the problem it was decided to build a new two-lane bridge about 60 feet upstream from the existing structure to carry northbound traffic, the existing bridge to continue to carry the southbound traffic, thus providing for a four-lane divided highway. This saves the cost of a temporary detour bridge, which would have been necessary if a modern four-lane bridge had been built on the

existing line. At such time in the future as the old bridge becomes inadequate to carry the southbound traffic it can be removed and a new southbound bridge constructed, all traffic being handled over the northbound bridge during period of construction.

The new bridge will be 1024 feet long. This is somewhat longer than the existing highway structure but slightly shorter than the parallel railroad bridge located about 115 feet upstream. The new bridge will have seven 60-foot spans, one 50-foot and one 42-foot span over the main channel and sixteen spans varying from 30 feet to 36 feet in the south approach.

It will be a continuous reinforced concrete girder construction. There are a total of five expansion joints



Constructing reinforced concrete bridge across Kings River near Kingsburg, Fresno County, to carry northbound traffic of proposed 4-lane divided section of U. S. 99.



The new bridge will be 1024 feet long with a 27-foot roadway. The existing bridge will carry southbound traffic.

located every fourth or fifth span at about the quarter point. Each span has four girders. For the 60-foot span the girders are 2 feet 3 inches deep at the center and 6 feet 3 inches at the pier. The roadway elevation is about 298 feet above sea level. High water was recorded in January, 1914, and December, 1937, at elevation 292. The new bridge has slightly more clearance above high water than the existing structure.

The channel spans are carried on reinforced concrete piers supported on timber piles. The bottom of the concrete footings is at elevation 263, about 10 feet below the bed of the stream. The piers are slender concrete walls 31 feet long, 15 inches thick at top of footing and 24 feet thick at the girder seat. The approach spans are supported on reinforced concrete piles, five piles per bent.

The bridge is being constructed under a contract awarded last May to A. Soda and Son of Oakland. The estimated cost of the bridge is \$125,000.

The approach roads will be included in a contract now being prepared for advertising for grading and paving

Surfaced Highways in U. S. Show Total Gain of 15,867 Miles

The total mileage of State highway systems in the United States on January 1, 1939, was 465,237 miles, being approximately 15 per cent of the total road mileage of the United States, according to an official report. The classification of improvements under general heads was as follows: Pavements of all kinds, 133,937 miles—a gain of 10,378 miles; macadam and gravel treated, low cost mix, amounted to 138,987—a gain of 6652 miles; sand clay and macadam and gravel untreated, totalled 102,582 miles, being 163 miles less than the year previous.

Therefore the total surfaced mileage amounted to 375,506 miles—a gain in surfaced mileage of 15,867 miles. Expressed in percentages the surfaced mileages are 82 per cent and the "dustless" or better roads are 59 per cent of the entire state systems.

the highway from Kings River to Kingsburg, for which an additional \$60,000 is set up in the 91st-92nd

budget. This will provide a four-lane divided highway from Kingsburg to a point one-half mile south of the bridge.

High Costs of Congestion

Traffic stops and starts cost motorists in the Los Angeles metropolitan area at least \$28,224,000 per year in wasted gasoline alone, according to estimates based on surveys announced by the Automobile Club of Southern California.

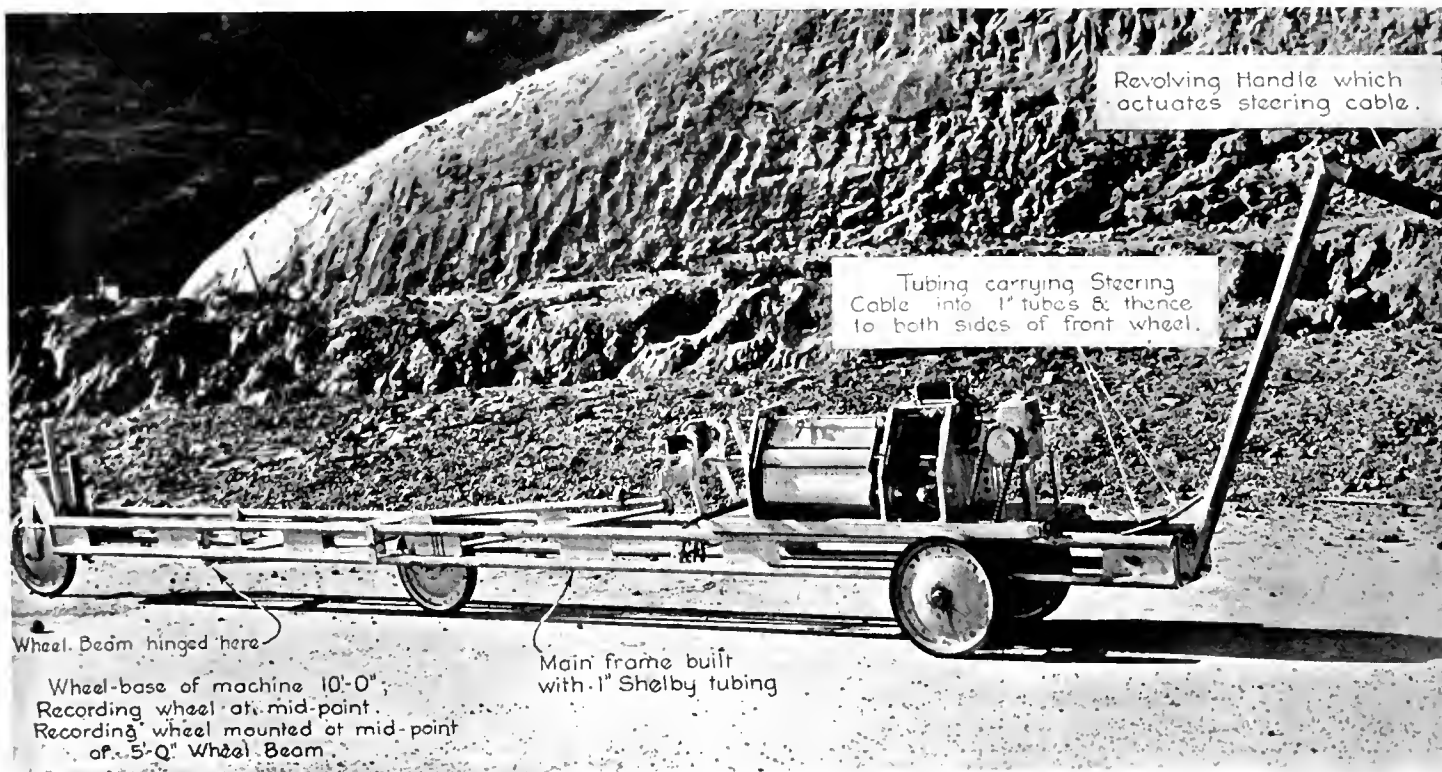
This hidden "stop-and-go tax," averaging more than \$28 annually for every car user, indicates clearly that motorists in this area are paying more to drive without nonstop, express motorways than it would cost to build them, says the club statement. A motorways network across the metropolitan area would eliminate most of the stops and starts necessary under present congestion conditions, it is held.

"And that is a sky scraper," announced the guide.

"Oh yeah? Well, let's see it work," replied the wise guy.

New Viagraph Makes Accurate Records of Pavement Roughness

By DOUGLAS H. GREELEY, Assistant District Maintenance Engineer



General view of newly designed Viagraph, a road surface meter machine equipped with recording attachments developed by highway engineers.

THE road surface meter here described is an instrument that will, no doubt, prove of great value. The automobile vialog has been in use many years but its limitations have often created a desire for something more useful—some means of securing a record that more accurately indicates road surface conditions and one that may be retained for future reference.

This need suggested an instrument that would produce a graphical representation, but if built in an automobile the new device would have weaknesses similar to the present vialog; its record would not agree with that of another instrument mounted on a different automobile, or could not be duplicated again if operated on the same automobile by a different driver.

Considerable discussion was had regarding a desirable instrument and finally it was learned that Mr. Claran F. Galloway, C. E., of the Los Angeles County Road Department, had successfully developed a surface meter that fulfilled many of the requirements. This instrument has had several years' service and has proved itself to be a useful one.

Mr. Galloway very kindly consented to allow the Division of Highways to build our machines, one being made in District VI and another in District VII. In addition to this he assisted with ideas during the construction of the one in Los Angeles and instruction regarding its use.

Essentially the road surface meter, which we also refer to as a viagraph, is the same as the original Galloway instrument. Some improvement in

design and construction was effected and a totalizer to record the travel of the graph pen has been added. This seemed desirable so that it would be possible to refer to the magnitude of a record in correspondence or reports. In addition an odometer was also added so that engineer's stations or distance might be observed. This instrument has been in use several months and has justified the hopes originally held for it.

The accompanying illustrations of the instrument probably make it unnecessary to describe it further except to convey a few essential details that are not apparent from photographs. The wheel base of the running gear is ten feet, a wheel that actuates the pen being situated at the mid-point, five feet from either axle. A true plane would result in the graph being

a straight line, otherwise the pen is raised or lowered as the instrument is wheeled over an irregular surface.

During operation, the chart paper progresses at the rate of one inch each twenty feet, the pen movement being at a ratio of two to one, i.e., a bump one-quarter inch in height will be drawn one-half inch in height on the chart. As this process continues, the pen's movements, in a positive direction only, are measured by its dial. This is accomplished by an overriding clutch which allows the negative movement of the pen to occur without measurement. Also during this process the distance is recorded on the odometer dial.

The instrument is operated at a walking speed, steering being accomplished by turning the handle in a manner used for throttle control on a motorcycle. A transmission is provided with a reverse gear which allows doubling back over the same course or an adjacent one on a parallel lane. This eliminates dead heading back to the point of beginning to make the other lane record.

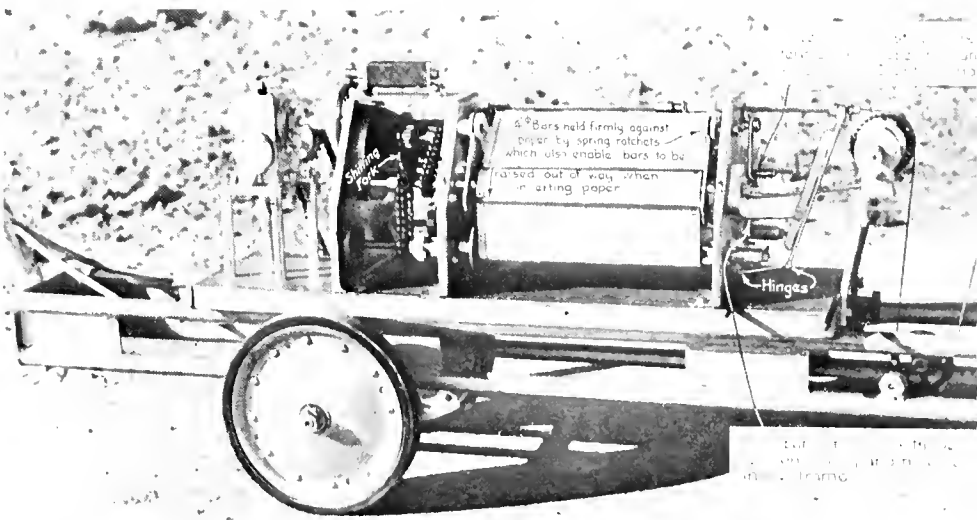
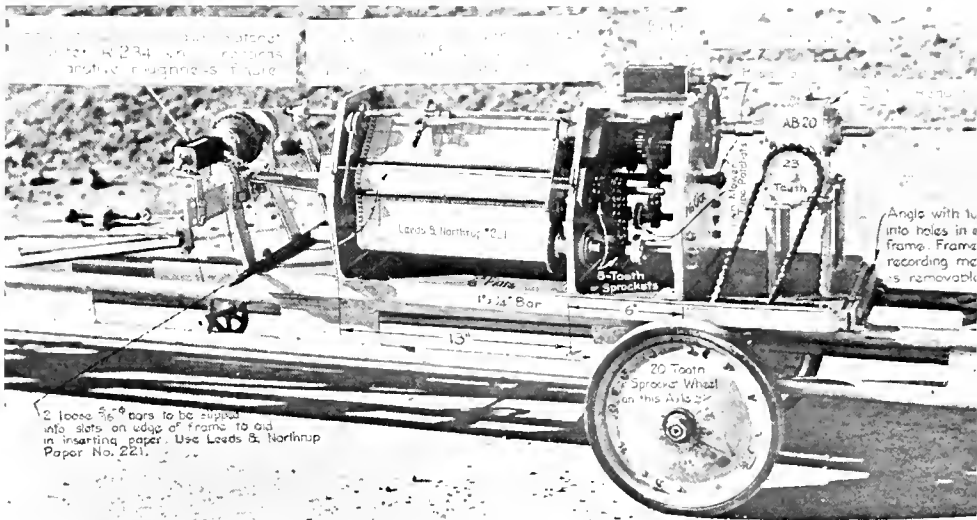
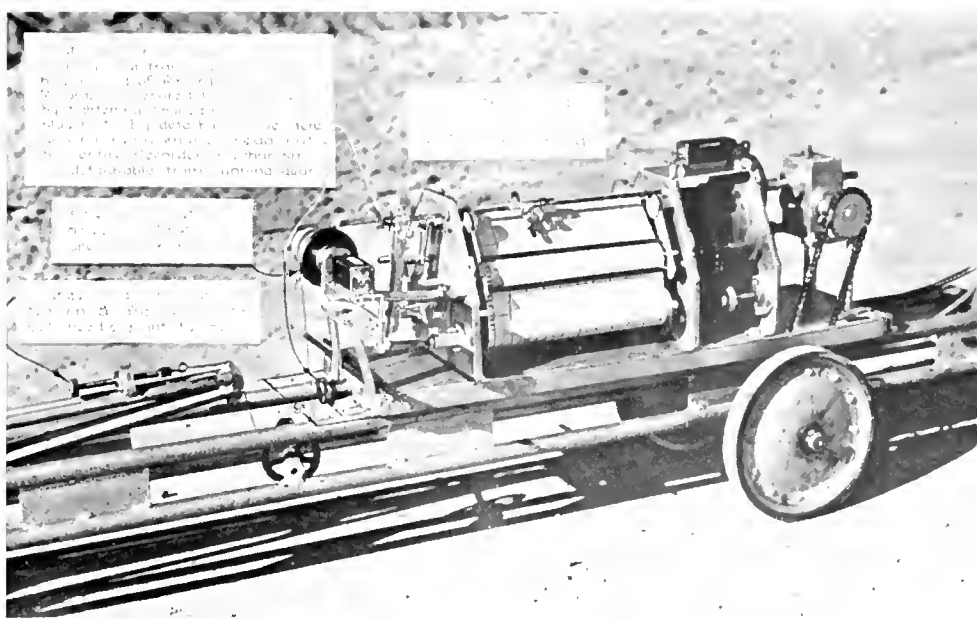
The instrument as it is now being used is the same as it is illustrated except that the solid-tired actuating wheel has been replaced with a pneumatic-tired one. It was found that this functioned better than the solid tire.

The Maintenance Department in District VII of the Division of Highways office in Los Angeles had long felt the need for a vialog or viagraph that would give consistent results. Many old pavements have been resurfaced in the past without any facility for determining either their roughness before the improvement or their smoothness afterwards, save, of course, the automobile vialog which was not generally available. Much work of this character will be done constantly and it will now be possible to record conditions before and after the improvement.

These two records, as well as subsequent ones, may be made on the same chart, as it can be put back in the instrument and rerun repeatedly, using different colored inks if desired.

Aside from the purpose of determining pavement riding qualities—the use the Maintenance Department is primarily interested in—the instrument has other important functions. With it Mr. Galloway of Los Angeles

(Continued on page 24)





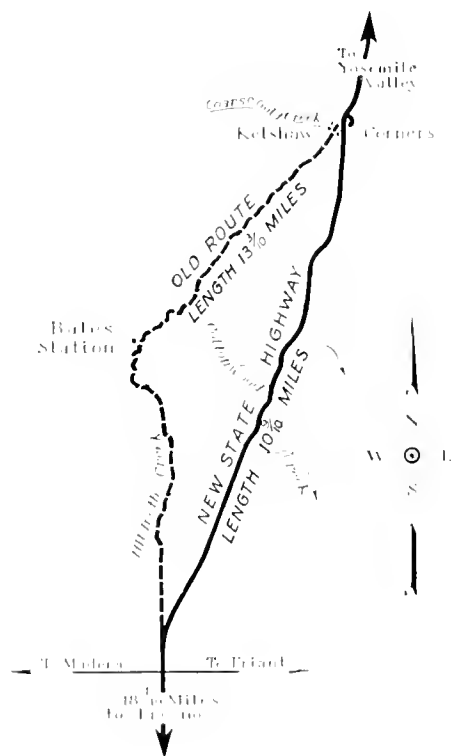
Section of new direct 10 mile highway link into Yosemite replacing 13 miles of narrow, tortuous old road.

Realigned South Approach Link To Yosemite Valley Completed

By R. S. BADGER, District Construction Engineer

THOSE who visited Yosemite Park several years ago, driving from Fresno via Lane's Bridge, northeasterly to the southerly park entrance, probably remember the mile after mile of narrow, tortuous roads through which they struggled before being rewarded by a sight of wonderful Yosemite. With the completion of the last unit of highway construction, the road now follows a very direct routing through the foothills and mountains of Madera County. The length of the trip is not only materially decreased but the alignment and grades are of such high standard that the trip is now a real pleasure, rather than an arduous task.

On August 1st Piombo Brothers, contractors, completed the last unit, except for surfacing. While the grading through the rolling granite hills was, in general, not particularly heavy, yet in one cut, 1300 feet long and with a maximum depth of 85 feet, the excavation amounted to 125,000 cubic yards, requiring the use of 115,200 pounds of blasting powder. Through this rugged cut the traveler now passes with little realization of the tremendous task



which its removal presented to the contractor.

Ruddy and Corfield, contractors

for the surfacing of this last unit, completed their work on October 31st. With a well-surfaced road the tourist may now enjoy the scenery while traveling, as compared to the nervous exhaustion that attended a trip over the crooked road of the past.

The new road misses some of the historical features of the old, which passed through "Bates' Station," a stage stop of the mining days, and dodged hither and thither around giant granite boulders where many a "hold-up" was staged in the "thrillful" past. However, the new road yet passes through Coarsegold, where miners still use goldpan and rocker to work the streams for the precious yellow metal. It runs thence to Oakhurst, which is the northeasterly terminus of the State construction. The highway beyond Oakhurst passes through Fish Camp, formerly a lumbering region and now a delightful summer resort country. Between Oakhurst and Yosemite a high standard highway was built by the U. S. Bureau of Public Roads for the U. S. Forestry and National Park services.

Formerly we had sidehill roads of



ten to sixteen feet in width, and curves, which would, proverbially, "break a snake's back" and the surface of which was a series of granite boulders covered by a light spread of soil and subject to ruttings and washouts from every shower. Now a smooth, dustless road of easy, pleasing curvature carries the traveler through the picturesque hills of Madera County.

Here the landscape is dotted with oaks; and in the springtime the "Giant Bush Lupines" add a beautiful splash of blue, while the white and lavender blossoms of the Chaparral delicately perfume the air. At the higher altitudes, pines with their fragrance replace the Oaks and Lupines.

At top, section of realigned south approach to Yosemite. Below, cut that required removal of 125,000 cubic yards of rock and scene during construction.



Traffic Far Outpaces Construction on Highway System

(Continued from page 7)

cities or is serving city needs. The development of the main rural highways is therefore of equal interest to both rural and city dwellers.

Our road problem is not solved with the construction of needed mileage. This investment must be preserved and maintained to give adequate service. Maintenance has become a problem not only of caring for the roadway, but in addition rendering many other traffic services. The most expensive of these additional services is the removal of snow on some 3500 miles of State highways.

This snow removal program has been a gradually increasing undertaking in response to the insistent demands of traffic. Keeping this mileage of road free from snow in the winter also introduces another necessary expense in sanding icy pavements.

Other services such as fire protection of adjoining fields by destroying roadside vegetation, the removal of noxious weeds, the eradication of ground squirrels, are of no direct benefit to the highway user but are legally required and cost money.

Landscaping or roadside beautification is another worthy item in highway construction.

Another very essential service is the constant study of traffic accidents and traffic movements, together with corrective measures contributing to safe and economic travel. Another related and necessary service is the erection and maintenance of proper signs and signals.

There are other items of service to the traveling public; however, suffice to say that to you and me as motorists it is very gratifying to know when traveling at night or in a storm that the road and our safety are constantly cared for by an efficient crew and that we may proceed without misgiving.

Highway transportation in California is still an expanding force. Its potentialities for good have not yet been fully realized. If permitted to develop freely and reasonably, it will provide even in larger measure new benefits to our people. Highways are built to serve the public, not to make a profit for government.

The community benefits immeasur-

ably from the highway and must continue to share the cost, and the ratio of this cost to be borne by the highway user and by the general public should be developed on an impartial and scientific basis. Highways contribute indispensably to education and are one of our State's greatest sources of opportunity and employment. Development of our highway transportation so that it will provide the greatest good to the greatest number requires the adoption of a rational, sound, long-term program of highway development based upon a proper analysis, interpretation and application of the facts now being developed by the State-wide Highway Planning Survey.

Such program naturally must be coordinated with the ability of the taxpayer to pay for highways. Motor vehicle taxes should be reasonable rather than punitive. By the adoption of a constitutional amendment preventing diversion of gas tax moneys, the motorists of California have insured themselves against the expenditure of highway funds for purposes other than that for which they are intended.

As I see it, the principal problems we must tackle are to get motor vehicles into and out of our cities; thoroughly modernize our primary highway system so that it will give key service for national defense as well as ordinary traffic; continue the improvement of the remainder of the highway system, with special attention to elimination of hazards such as grade crossings; develop secondary and feeder county roads; and to proceed as rapidly as possible to make safe for travel approximately 2300 inadequate bridges which, either because they are structurally unsound or because of dangerous approaches or narrow widths, should be replaced.

This can not be done over night. If you can think of a way to hasten the program of construction and repair so necessary and so urgent, I ask you to transmit your recommendations to our legislative body for their consideration. I purposely refrain from making any recommendation to you on the subject. Our job is to spend the money provided by law to the end that we do the greatest good

for the greatest number in our State.

In closing may I say to you that at this time the force of the Division of Highways of the Department of Public Works aggregates approximately 5100 persons. This includes maintenance, construction, clerical and engineering personnel. The division appreciates that a great responsibility of trust rests upon it, and maintains, therefore, a careful program of public and employee relations to the end that both the public and the employee will be properly informed of the execution of that trust. All departments and their respective heads are readily accessible to the public.

Every effort is made through the medium of a monthly magazine and daily press releases to keep the people informed concerning the expenditure of their gas tax and motor vehicle fee contributions to the highways.

Prior to the construction of new road projects the Division of Highways seeks expression of public opinion on the proposed improvements.

By the very nature of its operations the Maintenance Department of the Division of Highways has the greatest amount of public contact. It is, in itself, a public relations department and every employee has been deeply schooled in courtesy to the motoring public. Maintenance men are constantly on the highways, they are constantly observed by the traveling public, and noted by the adjacent land owners. They daily render aid to motorists in stalled cars.

Public and employee relations of the Division of Highways are zealously guarded and it is honestly felt that few departments of the size of this one have such friendly relations with the public on one side and such high loyalty of its employees on the other side. Altogether, the Division of Highways has made an enviable record and I bespeak your continued cooperation with it in the interest of our State.

I appreciate this opportunity to discuss with you the problems of the Highway Department. Your assistance and sympathetic cooperation in building our highway development program will, I assure you, be deeply appreciated.



Before and after views of Cypress Avenue approach to Bay Bridge distribution structure in Oakland showing effect of appropriate plantings.

Landscaping Bay Bridge Approaches

By H. DANA BOWERS, Landscape Engineer

OF THE 1939 Fiscal Year Federal Aid Landscaping Funds there has been allocated approximately \$15,000 to complete the landscaping of the East Shore Highway Approach to the San Francisco-Oakland Bay Bridge, from the east end of the bridge in Oakland to University Avenue in Berkeley, a distance of 4.6 miles.

The project now under way is from the Distribution Structure to the Toll Plaza on the south side of

the highway. This section was omitted from the original landscaping project by reason of construction of the interurban railroad tracks from Oakland to San Francisco over the bridge.

Upon completion of this section all of the approaches to the Bay Bridge will have been landscaped. These include the Fifth Street Plaza in San Francisco, and the east side of the Distribution Structure in Oakland.

Due to the severe offshore prevail-

ing winds often carrying salt spray completely across the road and the dredged sand and clay fill in which it was necessary to plant, the problems of plant material selection were manifold. The importation of top soil, installation of water lines, construction of curbs, parking areas and drainage control all combined to make this the most costly to date of any of our landscaping projects.

Preparation for landscaping was included in the roadway construction



Screening of unsightly dumps and industrial district by tree plantings is shown on this section of East Shore Highway approach.



Improved roadside appearance provided by tree and shrub plantings that screen buildings on Moss Avenue approach in Oakland.

contract. The preparatory items and their costs were:

Installing Water Line Cross-overs under Pavement.....	\$7,052.37
Imported Topsoil	4,724.25
From 1937 Federal Aid Funds there was allocated:	
Installation of Curbs, Parking Areas and Water Lines (by Contract)	26,828.00
Planting Trees, Shrubs and Ground Cover (Force Account)	59,361.21
From 1939 Federal Aid Funds to complete the project:	
Planting Trees, Shrubs and Ground Cover and Install Water Lines (Force Account)	14,750.00
Total Cost of Project.....	\$112,715.83
Cost Per Mile.....	\$24,250.±

A solid screen planting was made on the east and south sides of the approach to obscure from view the industrial district and interurban

railroad tracks immediately adjacent. Groups of Monterey Cypress in the screen planting were placed to break up the formality of the continuous shrub mass and create skyline effects.

All planting was done thickly in order that the plants would afford protection for one another. Shrubs that normally would have been planted from ten to fifteen feet apart were planted from three to five feet apart.

All varieties used are doing exceptionally well to date with the exception of the *Melaleuca nesophila* at the lighting standards in the center dividing strips. These solitary plantings on the north and south section of the approach have not been able to withstand the burning winds. On the east and west section, however, they have been quite satisfactory as they are not subjected to the severe expo-

sure of the north and south section.

It is interesting to observe on this project how the growth of the plants is affected by the various conditions of exposure. On the east and west section, from the Bridge to the Distribution Structure the road runs with the direction of the prevailing winds. The planting is for the most part in between the highway and the interurban railroad tracks. No wind burn or distortion is noticeable on any of the varieties.

From the Distribution Structure north, the conditions are more drastic, however. The slight protection afforded by Yerba Buena Island and Treasure Island is sharply evident.

Traversing north toward University Avenue a rapid change takes place in the condition of the trees and shrubs. The winds have an unobstructed sweep over the bay in from



Typical planting of entire east shore approach. Group plantings along Berkeley Aquatic Park, with ice plant ground cover on bayside and center strip.



Before—Dredged sand fill between east end of bridge and Toll Plaza. After—Ice plant ground cover on bayside and center strip.

the Golden Gate north of the islands, between approximately Folger Avenue and University Avenue. While the growth has been fair, their form is prostrate and there is some burning from the salt spray and wind.

Plantings against buildings in an area of "dead air" show no wind effects and have made a normal growth.

It is to be observed that under these conditions plants appear to succeed better in front of the windbreaks, rather than in behind, due of course, to the lack of eddies or drafts caused by solid windbreaks.

The following plant varieties and quantities were used on this project:

<i>Acacia longifolia</i>	5,411
<i>Melaleuca nesophila</i>	2,859
<i>Melaleuca armillaris</i>	2,549
<i>Cupressus macrocarpa</i>	596
<i>Leptospermum laevigatum</i>	2,010
<i>Sambucus glauca</i>	356
<i>Myoporum laetum</i>	200
<i>Baccharis pilularis</i>	846
<i>Pyracantha yunnanensis</i>	915
<i>Mesembryanthemum edule</i>	210,000
<i>Mesembryanthemum croceum</i>	105,445

In addition to 15,000 cubic yards of topsoil imported under the construction contract, 7272 cubic yards was imported for the purpose of back-filling planting holes. Thirty-six hundred and twenty-seven cubic yards of stockyard manure was mixed with the top soil and spread over the ground cover areas.

Before planting it was necessary to place all plant material in a semi-exposed location for several months for acclimatization. If this acclimatizing is not done, even the hardiest varieties taken from the protection of the nursery would burn to the ground immediately under the force of the wind.

On the bay side all planting was confined to ice plant ground cover and notwithstanding the drenching it receives from salt spray it has made a satisfactory cover for which the only maintenance necessary is the trimming along the curbs.

The completed portion of the approach as it now stands is well estab-

lished and is maintained by a crew of two men plus equipment and water costing some \$5,000 per year.

The Fifth Street Plaza approach in San Francisco was planted in May, 1937, at a cost of \$16,210.71. Large boxed specimen coniferous material was used to give an immediate effect for the opening of the Bridge.

Here, again, the prevailing winds have had their effect on the plants. It has been necessary to replace the Lawson Cypress with broad-leaved evergreens such as *Pittosporum crassifolium*, *Melaleucas* and *California Cherry*, that are able to adapt themselves to the conditions.

The Coast Redwood, *Thuja plicata*, Incense Cedar, Blue Mt. Atlas Cedar and Camnart Red Cedar have done well toward the back, where they protect each other. Irish yew, Wissell Cypress, Pfitzer Juniper and Japanese Boxwood have made a good showing under exposed conditions.

The lawn area contains 64,000

(Continued on page 21)



Fifth Street Plaza approach in San Francisco where prevailing winds have compelled replanting with evergreen trees and lawn shrubs.

A. A. S. H. O. Urges U. S. to Stop Diverting \$150,000,000 Road Fund

By C. H. PURCELL, State Highway Engineer

OF PARTICULAR interest to California are several resolutions adopted by the American Association of State Highway Officials at its twenty-fifth annual convention in Richmond, Virginia.

Should Congress see fit to follow the recommendations of the association relative to more generous distribution of Federal income from highway users, this State may receive more Federal aid for road building in the future.

Calling attention to the fact that surveys reveal that there are one hundred thousand miles of obsolete and inadequate roads and 19,000 bridges which need rebuilding in the United States, a resolution adopted by the convention points out that whereas the annual Federal income from highway users is approximately 350 million dollars, the government now diverts about 150 million dollars for purposes other than highway construction, while at the same time penalizing States for the diversion of highway funds.

The resolution resolves, "That this association urges the Congress to authorize for expenditure through The Public Roads Administration all the Federal income from the highway users for the construction of the Federal Aid System, forest roads, park roads and public land roads."

California Division of Highway engineers who attended the convention supported a resolution which was adopted favoring the building of freeways, provision for which in this State was made in a bill adopted by the last legislature and approved by Governor Olson.

The resolution provided, "That legislation be sought wherever practicable in every State of the Union to give to State highway authorities wherever they are not already in possession of it:

"1. Authority to build limited access highways in suitable locations;

American Association of State Highway Officials Washington, D.C.

In testimony of our appreciation of the splendid services rendered to the States of the Union while he was president of this Association, we make grateful acknowledgment to

C. H. Purcell

The presidency of this organization comes only to those who have rendered signal service in meeting the problems confronting the development and improvement of our highways. We realize that those who help to solve many public questions are not guided by monetary considerations nor is it possible to estimate the ultimate benefit from such labors. These facts only accentuate the value of the services performed.

To one who gave unstintingly of his time and energy for this Nation wide cause, we heartily give this expression of our confidence and extend to him our well wishes for continued usefulness and highest attainment.



October 10, 1939

W. A. M. C. C.
President
H. J. M. C. C.
Secretary

Testimonial awarded State Highway Engineer C. H. Purcell by A. A. S. H. O. convention.

"2. Authority to acquire sufficient width of rights of way to protect the public investment in the highways and to reduce hazards;

"3. Authority to make and enforce regulations controlling the uses of private property abutting on State highways."

California's policy of endeavoring to abolish toll roads was supported by the adoption of a resolution reading as follows:

"WHEREAS, This association 25 years ago used its best efforts to free all State highways of tolls and succeeded in having the Congress of the United States write such a requirement into the Federal Aid Act; and

"WHEREAS, This has been of great value and convenience to the traveling public; therefore, be it

"Resolved, That this Association reaffirms its action of 25 years ago against tolls on all highways."

The California Division of Highways has been extending its roadside beautification program for several years and the following resolution won the support of the California delegates:

"Resolved, That this Association recognizes the great importance of the acquisition of adequate rights of way to preserve the natural beauty of our highways and recommends to the States, the Public Roads Administration, and the Congress suitable

legislation to achieve this important result."

With California launched upon a comprehensive program to relieve congested traffic conditions in metropolitan areas, the following resolution was of interest to the representatives of the Division of Highways from this State:

"WHEREAS, The State Wide Planning Surveys have developed factual information relative to seriously congested traffic conditions in the regional areas adjacent to metropolitan centers; and

"WHEREAS, Such traffic bottlenecks result in great economic loss and within the metropolitan areas seriously retard commerce; therefore, be it

METROPOLITAN AREA CONGESTION

"Resolved, That this association recommends an early start toward providing adequate transportation facilities in such regional areas and metropolitan centers and where traffic justifies between such regional areas and metropolitan centers of sufficient capacity to provide for the safe, uninterrupted and rapid flow of traffic; and be it further

"Resolved, That this association recommends that the several States and the Federal Government give early consideration to the development of a land policy that will make legally possible the acquisition of necessary rights of way for such adequate transportation facilities, with costs for land being amortized over a long period of years through rental or resale of land taken contiguous to the right of way proper, or other appropriate means."

From Dean of College

New York University,
College of Engineering,
University Heights, N. Y.

Office of the Dean.

Editor California Highways
and Public Works,
Sacramento, California.

Dear Mr. Howe:

I greatly appreciate your kindness in having my name put on your mailing list to receive the current and future copies of your official magazine "California Highways and Public Works." I shall look forward with interest to receiving copies of this magazine.

Yours very truly,

(Signed) THORNDIKE SAVILLE,
Dean.

Monterey Highway Pavement

(Continued from page 8)

On this subbase it is planned to place a 4 inch crusher run base for a width of 23 feet. On this crusher run base will be a plant-mixed surfacing 3 inches thick and 22 feet wide, using a medium curing cutback road oil. This will be followed by an asphalt emulsion and screening seal which should give a very satisfactory surfacing, both from a maintenance and traffic standpoint. The 8 foot shoulders on each side of the pavement will be of imported borrow or select material and the top 3 inches road-mixed with SC-3 oil.

The following statistics may be of interest:

Feature	Present	Proposed
Total number of curves -----	20	13

Feature	Present	Proposed
Number of curves 1000' radius or less -----	9	0
Minimum radius	500 feet	2000 feet
Maximum grade	7%	1.89%
Right of Way width -----	60 feet	130 feet
Minimum sight distance -----	310 feet	1010 feet

The minimum sight distance of 1010 feet occurs only in one instance, the balance of the roadway having a sight distance of over 1600 feet.

According to early traffic census records, this section of road when built was carrying about 600 cars and 15 trucks per day. In 1925 when the first of the regular State-wide traffic surveys was made, the traffic had increased to a total of about 1500 vehicles of which about 2 per cent were trucks. There has been a steady increase of traffic since that date, and the 1939 count showed 3000 to 3400 total vehicles and 5½ to 9 per cent of this number were trucks.

By way of beautification along this section it is proposed to ballnose or round off the ends of cuts as well as round the slopes. There will be approximately 20 parking areas, which will be oil surfaced. The cut slopes are generally 1½:1 and provision has been made for blanketing these cut slopes with salvaged top soil on which will be sown at a later date western rye grass, as the material in these cuts generally erodes quite severely.

The present bridge across the Salinas River near the mouth of the Nacimiento, consists of four 150-foot steel truss spans and twenty-seven 19-foot timber trestle spans with a roadway width of only 16 feet 5 inches and a vertical clearance of only 13 feet 11 inches. The condition of the bridge required its being posted for a speed limit of 5 miles per hour for vehicles 10 tons or over in weight. This structure was originally built by the county of Monterey in 1916 and, like the concrete pavement on each side of it, has well served its time.

The new structure will be a reinforced concrete girder bridge consisting of fifteen spans, varying in length

(Continued on page 24)

Signs Appreciated

California Institute of Technology, Pasadena

Department of Public Works,
Sacramento, California.

Gentlemen:

A few weeks ago I came from Bishop to Pasadena over Highway 395 after a heavy desert storm. In places the highway was flooded with deep sand and gravel.

I wish to take this opportunity to congratulate your department for the most efficient and complete manner in which you posted this road with emergency signs. To one who travels this road as often as I do and to be caught at night in a typical desert storm I can not help but express my appreciation to you for what you did to make my trip, as well as all other motorists, a safe one.

With every wish for a continuance of your fine work, I am,

Yours very truly,

WM. W. MICHAEL,
Associate Professor of Civil
Engineering.

University Avenue Underpass At Palo Alto Under Construction

By GLENN L. ENKE, Associate Bridge Engineer

PALO ALTO citizens are looking forward to the completion of a new underpass separating the University Avenue crossing of the Southern Pacific Railroad adjacent to State Highway Route 2, in Santa Clara County, more familiarly known as El Camino Real.

University Avenue, in addition to being Palo Alto's main business thoroughfare, serves as a direct connection between Palo Alto and Stanford University. Vehicular traffic counts show heavy traffic flow across the railroad tracks at peak hours of the day, traffic being especially congested during the arrival and departure of daily commuter trains between Palo Alto and San Francisco. Approximately 80 passenger trains travel over this crossing daily, most of which stop on the crossing during loading and unloading of passengers.

The highway underpass, known as University Avenue Underpass at Palo Alto, is now under construction. An excellent model of the structure, as it will appear when completed, was built under the direction of Thelo Perrott, assistant city engineer of Palo Alto, by members of the city fire department, and is shown in the accompanying illustrations.

COST IS \$400,000

Bids for the project were opened on November 8, resulting in the award of a contract to Paul Tyler of Oroville. Considerable track work will be performed by the Southern Pacific Company directly chargeable to the project. In addition, the railroad is constructing a new station, baggage room, and parking area at its own expense, while the city plans to widen Alma Street, a commercial thoroughfare paralleling the railroad, and construct additional parking areas.

The combined cost of the various elements involved will approximate \$400,000. Necessary right of way was secured by the city of Palo Alto. The project is financed from Federal

Grade Separation Funds, including that portion of the railroad work and relocation of city-owned public utilities made necessary by the construction of the subway.

Success of any grade separation project from the public user's standpoint is largely contingent upon two factors: (1) An attractive superstructure; (2) Good riding characteristics. Adequate structural strength and economical design are fundamental requirements.

The entire underpass layout has accordingly been developed with simplicity of outline and proper proportioning of structure as essential requirements. The approach ramps have been carefully designed to provide smooth superelevated transitions between intersections.

RAILROAD TRACKS SHIFTED

Basically, the project provides for separation of highway traffic along University Avenue and train movements along the double track Southern Pacific Railroad at Palo Alto. To fit existing street levels along the Alma Street traffic circles and University Avenue, it was necessary to elevate the railroad five feet and to shift it southward toward El Camino Real approximately 81 feet. The two existing tracks will be moved to the new alignment and a new third track constructed, beginning near the Palo Alto Avenue crossing and ending opposite Addison Avenue in Palo Alto.

University Avenue will be divided into two 25-foot traffic lanes separated by a six-foot landscaped island strip widened at El Camino Real to conform to the existing traffic island at the Stanford University entrance.

Alma Street will be carried over University Avenue on a highway structure providing a 45-foot roadway. One-way access lanes 22 feet wide, separated by landscaped traffic islands, will connect Alma Street with University Avenue. On the southern side of the tracks, a cross-over struc-

ture with 26-foot roadway will serve two-directional traffic between University Avenue and the railroad station.

PEDESTRIAN WALKWAYS

Pedestrian walkways and tunnels 8 feet wide will be constructed along both sides of University Avenue with four pedestrian ramps joining these tunnels to the railroad station platform area. Provision is made in the structure proper for a future fourth track, with railroad station facilities laid out to permit its ultimate construction.

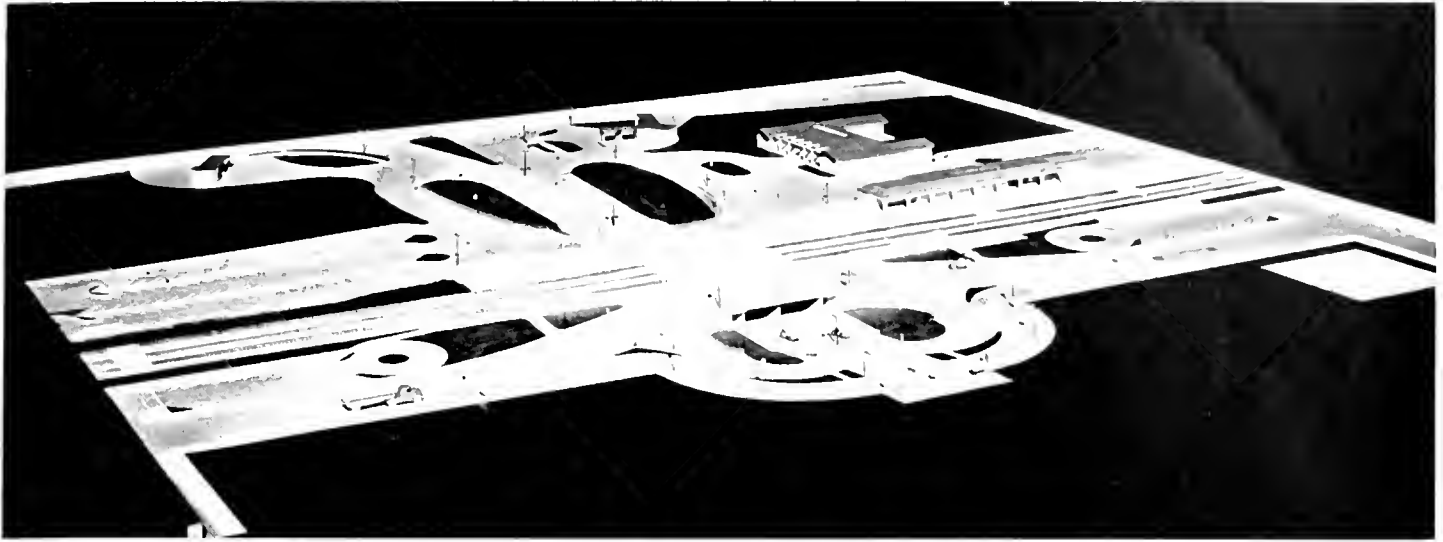
The Southern Pacific Company is building a pedestrian underpass to connect the Alma Street parking area to their new station. Their present freight station is being moved to a new location at California Avenue, approximately two miles to the east.

The highway structures are of continuous concrete slab construction over center piers with ends supported upon abutments of double deck cellular type. The upper decks of these cellular abutments serve as pedestrian tunnels, while the lower halves are available as storage capacity for storm water during extreme rainfall conditions.

RAILROAD STRUCTURES

The railroad structures consist of continuous steel beam spans supported upon concrete piers and abutments of the same type used for the highway structures. Each track structure is constructed as a unit, using six 30-inch steel beams supporting a $\frac{1}{2}$ -inch wrought iron ballast plate and two 15-inch steel channels to confine and support the ballast for the track.

Operation of trains over a ballasted bridge structure creates no more noise than operating over standard road-bed construction. Passage of trains over the structure will be considerably more quiet than if ties had been placed directly upon the steel beams.



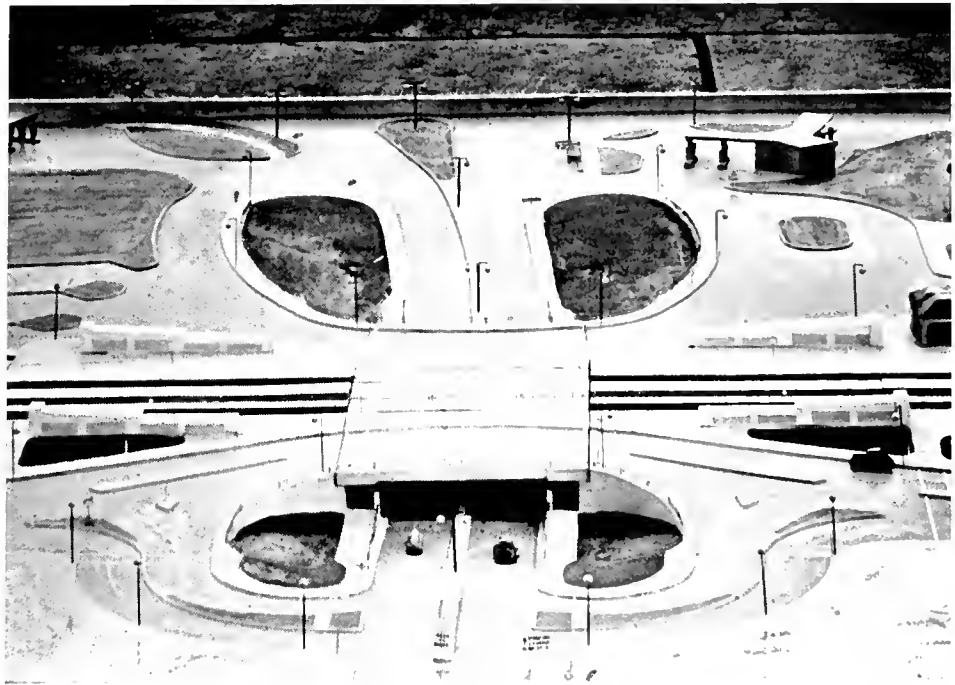
Model of University Avenue grade separation project in Palo Alto made by Assistant City Engineer Perrott and members of fire department.

The railroad abutments, piers, and superstructure are completely isolated from the highway and platform structures, which will eliminate the sensation of train vibration to persons standing on the track platforms or sidewalks. This involves the use of 1-inch water-tight expansion joints between all structures to exclude moisture from the pedestrian tunnels. For this purpose, copper strips will be sealed in the concrete adjoining each joint, together with a rubber-type pre-molded expansion joint filler.

FOUNDATION CONDITIONS

Creosoted timber piles will be used to support all railroad and highway structures, and certain portions of the higher retaining walls immediately adjoining. A number of test borings were made and an open test pit dug to determine the true foundation conditions. Analysis of the soil samples indicated that suitable foundation material would not be found above Elevation +35. We have placed all structure footings at Elevation +44, just low enough to clear the low point of the underpass pavement. Ground water is at Elevation +15, and will not interfere with construction.

Comparative cost estimates indicate it more economical to use short piles with footings at the higher elevation than to excavate the additional nine feet and construct abutments capable of resisting greatly increased earth pressures and horizontal trac-



tive forces resulting from train operation. The structures are also designed to resist seismic (earthquake) forces.

Pedestrian ramps are protected from the weather with concrete hoods. Large areas in the sidewalls of these are filled with glass blocks instead of the usual wire-reinforced window sash. A very modern appearance is gained thereby, as well as elimination of maintenance costs.

University Avenue through the depressed portion will be paved with portland cement concrete. The approach streets, ramps, parking areas, and station platforms will be surfaced with an asphalt-type pavement.

All sidewalk handrailing is made

up of 4-inch square steel tubular top rails, supported upon $4\frac{1}{2}$ -inch square steel posts placed in the concrete sidewalk curbs on 7-foot centers. Vertical baluster bars 1-inch square on 6-inch centers connect between top rails and 3-inch steel channels embedded in the concrete curb. All connections are welded and are so concealed that the railing presents a very smooth appearance. It will be painted an aluminum color.

This type of railing design has an inherent safety feature in that all vertical members disappear from view when observed from an automobile traveling at any speed above two or

(Continued on page 25)

Viagraph Makes Accurate Records of Roughness

(Continued from page 13)

County has definitely established portland cement pavement curling cycles. With this possible, a study of subgrade soil characteristics was made which shows that the 20-foot panels of portland cement pavement gradually curled more and more during the dry period of the year and that immediately after the first rain this curl disappeared, not to return again until the dry season when it started the cycle over again. No doubt there is a definite relationship between this behavior and subgrade soil characteristics.

It has been found that paving crews are always interested in the record the machine supplies. Since it can be used on the current day's run of portland cement pavement before a bump-cutter is employed, better results can be attained in finishing. Poor joints at once become apparent and can be corrected while concrete can still be cut. Bituminous pavement can be checked during the laying of the base and subsequent courses and in the case of blade grader finish work it is easy to determine the difference in grader operators.

Much credit is due Superintendent W. B. Cannon and the District shop organization for their part in constructing this instrument. On account of Mr. Cannon's interest, various refinements and improvements were made possible.

Monterey Highway Pavement

(Continued from page 21)

from 14 feet to 130 feet, and will have a roadway width of 26 feet with a clear walkway on each side through the medium of a widened curb so that pedestrians can obtain a safe standing space while crossing this bridge.

A total of 240 working days have been set up for the completion of the road work, which will bring the completion date to about the middle of August, 1940, and the bridge contract should be completed shortly thereafter.

Hemstreet and Bell of Marysville are the contractors.

Bay Bridge Traffic for November Shows Gain Over Preceding Year

TRAFFIC over the San Francisco-Oakland Bay Bridge for November showed a five per cent gain over the same period a year ago, but a considerable drop from the record shattering figures of October.

A total of 822,494 vehicles crossed the Bay bridge in November, Director of Public Works Frank W. Clark reported to Governor Olson. The water front strike, the close of the Exposition, the holding of the Big Game at Stanford, and the St. Mary's game in October were given as factors which contributed to the lowering of the November total.

Exposition-bound traffic grossed the bridge an approximate total of \$930,000. The figures comprise the period from October 27, 1937, when workmen were first able to go by automobile

to Treasure Island, until the closing day of the Fair, October 29, 1939.

Approximate figures indicated that the total number of vehicles carried by the bridge to the Exposition during that period was 1,950,000 carrying some 4,900,000 persons, or approximately one-half of the total number of visitors to attend the Fair.

Total vehicular revenues for last month were \$350,663.82 compared to November, 1938, income of \$410,709.65, while daily traffic averages for the comparable period were 27,416 and 26,108, respectively. Thanksgiving, November 23, was the high point of the month with 36,955 vehicles crossing the span. Total number of vehicles to cross the bridge this year to December 1st was 10,109,019, bringing the total since the opening of the bridge to 29,170,208.

	Auto and Trailer	Motorcycles and Trailers	Buses	Truck and Trailer	Freight Tons
November, 1939-----	743,127	3,184	16,329	44,220	53,386
November, 1938-----	709,446	3,671	13,239	41,503	57,961
Total for 1939-----	9,187,991	39,979	109,307	516,334	665,707
Total since opening--	26,895,663	126,878	356,941	1,276,233	1,576,837
Total Vehicles for November, 1939-----					822,494
Total Vehicles for November, 1938-----					783,252
Total Vehicles that Crossed the Bridge During 1939-----					10,109,019
Total Vehicular Traffic since Opening of Bridge in November, 1936					29,170,208

Landscaping Bay Bridge Approaches

(Continued from page 19)

square feet planted to Seaside Bent Grass.

On the east side of the Distribution Structure in Oakland the planting was sponsored by the city of Oakland installed with WPA labor. Many large Monterey Pines 18'-20' in height were moved in to frame the structure approaches. Eucalyptus trees were planted between the distribution lanes and to screen from view the industrial district.

This portion of the Bay Bridge approach is maintained under permit by the city of Oakland.

"I say, Mary, isn't it time baby said 'Daddy'?"

"No, Jack, we've decided not to let him know who you are until he gets stronger."

Roads as Old as History

Building of roads is one of the most ancient basic functions of government. Throughout history it has been one of the first cooperative activities of a community.

In the United States the citizens in most communities joined in building roads long before other services were undertaken.

Roads, until the advent of the motor vehicle, were regarded as a direct responsibility of the community. In the Colonial days, laws were passed requiring all able-bodied men to work a certain number of days each year upon the highways. Property holders were assessed both in money and in labor.

Husband—"I've made up my mind to stay home this evening."

Wife—"But I've made up my face to go out."—*Chicago Times*.

University Ave. Underpass Under Construction

(Continued from page 23)

three miles per hour. The top rail then becomes the only visible part of the railing, appearing as a narrow 4 inch band. This feature results in very little interference to vision of the operator of an automobile, and will enable him to see through the railing while traveling around an approach ramp.

Heavy rainstorms will not handicap use of the structure. Six catch basins in the depressed portion of the roadway will drain storm water into a sump southwest of the structure from which two 1500 gallon per minute capacity pumps will deliver it through a 16-inch steel pipe line into San Francisquito Creek, 2000 feet away.

DRAINAGE SYSTEM

Approach ramp grades on both sides of the track have been carefully designed to exclude adjacent ground and city street drainage from the underpass. Nevertheless, some 200,000 square feet of pavement and platform area will drain into the depressed roadway. Drainage from an area of this type is practically instantaneous and must be handled at once. As the city's storm sewers in the immediate vicinity are inadequate for 3000 gallons per minute discharge, a drain line from the sump into the nearest stream became necessary.

The pump house proper, immediately above the sump, will be placed below ground with its top flush with the station platform. A pump house is always difficult to design architecturally harmonious with the surrounding landscape, and is desirable to submerge below ground where possible. Operation of the pumping plant during a storm is automatic and is controlled by float-actuated switches that start and stop either pump as conditions demand. In addition, there is a safety float switch operating a signal in the fire department which will come into action in event of failure of the pumping equipment to handle the storm water. Access for equipment and machinery is provided in the roof, while ordinary



Emblem Plaque of Quarter Century Club.

access for inspection is made through one of the pedestrian ramps.

TWENTY-FOUR HOUR LIGHTING

Twenty-four hour lighting within the underpass and pedestrian tunnels and ramps will be necessary, as the depressed portion under the structure is 179 feet long. Roadway lighting is set flush in the sidewalls on either side of the roadway and will illuminate the entire pavement surface without glare. Street lighting is also provided along University Avenue, all approach ramps, and throughout the station platform. Existing electroliers will be relocated for this purpose, supplementing them with new electroliers of modern design along the 6-foot dividing strip.

All construction operations will be carried on without interference to train schedules or passenger facilities. The present station, baggage room, and news stand will be shifted to a temporary location on Alma Street opposite Lytton Avenue. Work will be prosecuted such that Alma Street will rarely be closed during construction. One-way operation will prevail for a short time toward the conclusion of the work.

The contractor will complete all structures and a sufficient quantity of railroad embankment to enable the railroad to lay its new passenger track. Eastbound trains will then be turned onto this new track and the existing eastbound track shifted to the new location. Westbound trains will then be shifted to the passenger track, and the present westward

(Continued on page 26)

Quarter Century Club Organized in Highway Div.

Some time back this magazine published a series of articles on old-timers of the State Highway Department. These old-timers take pride in their long service and have a growing feeling of comradeship which comes with years of association. Today they have formed themselves into an organization and have adopted as its name The Quarter Century Club. The purpose of the club is purely social—a get-together organization, as it were, where members available can meet occasionally and can break bread and reminisce on the past.

The Highway Department was organized in January, 1912, and while there were twenty-five persons who had served the State twenty-five years by the end of 1937, the Quarter Century Club organization was not completed until 1939 and these twenty-five persons are the charter members. Others become eligible for membership as rapidly as they attain their twenty-five-year service, and today there are more than 50 such persons eligible.

CHARTER MEMBERS

C. N. Ainley	R. M. Haverstick
H. F. Allen	F. T. Maddocks
F. R. Baker	Grant P. Merril
E. J. Bassett	C. P. Montgomery
T. A. Bedford	James Moriarty
C. M. Butts	Myrtle Murray
S. V. Cortelyou	D. N. Sapp
S. Crespo	Leona D. Smith
H. C. Darling	R. H. Stalnaker
A. N. George	T. E. Stanton
L. H. Gibson	R. A. Tremper
Geo. Hanson	G. R. Winslow
F. W. Haselwood	

The emblem which the club has adopted and which is pictured above ties in closely with the seal of the Highway Department. It is circular in form and enameled in color and mounted on a plaque; the year in which the club was formed is shown at the top; at the bottom is a blank for the member's name and dates of service if he so desires.

The officers of the club this first year are: President, Thomas E. Stanton; First Vice President, T. A. Bedford; Second Vice President, S. V. Cortelyou; Secretary-Treasurer, George R. Winslow; and Historian, Fred T. Maddocks.

University Ave. Underpass Under Construction

(Continued from page 25)

track removed and stockpiled. The contractor will then complete his work in the area previously occupied by the railroad. Excavation in this area will furnish additional embankment for the new westward track, which will then be laid. As the total embankment requirements exceed available excavation by approximately 28,000 cubic yards, it will be necessary to import additional material from borrow pits.

Relocation of gas, electric, telephone, fire alarm and water services, and storm sewers and sanitary sewers are a necessary part of the construction, and are present in any project within city limits.

The Bridge Department of the California Division of Highways designed the structure and will direct its construction. Mr. G. W. Thompson is Resident Engineer for the State. Maintenance of the structure will be divided between the Southern Pacific Railroad and the city of Palo Alto.

The project will be completed for traffic about the first of the year 1941.

Major Operations Required for Traffic Relief in Large Cities of U. S.

That the larger cities will require major operations to alleviate critical congestion has been particularly emphasized in the report of the Bureau of Public Roads to Congress on the subject of toll roads. Figures of motor vehicle registrations in cities of over 100,000 population demonstrate the urban conditions which necessitate bold measures for traffic relief.

In the 95 U. S. Cities having populations exceeding 100,000 live 40 million persons owning more than 8 million motor vehicles. These constitute 31 per cent of the total population and 27 per cent of total vehicle registrations. The area of these 95 cities is 4,488 square miles, or fifteen one-hundredths of one per cent of the total national area. The density of motor

Thanks Highway Men

State Highway Dept.,
Sacramento.

Gentlemen:

I wish to draw to the proper person's attention some very courteous treatment we received from two members of the road division on September 25th.

We were in Red Rock Canyon, just out of Mojave, and in attempting to ford a small stream crossing the highway we became stalled.

Your truck No. 3512 driven by a Mr. Monroe—assisting him was Mr. C. P. Smith—not only pulled us out but pushed us to the nearest garage where we received help and were on our way.

We tried to compensate these two men, they thanked us, but would not accept one penny, stating they were paid by the State and the tax payer was due for what little help they had extended. I want you to know I deeply appreciate this act of courtesy.

Sincerely,

(Signed) H. B. LEARNED.

Funds Decreased for Highways in 1938 \$98,717,000

THE annual report of the American Association of State Highway Officials presented at its recent convention in Richmond, Va., states that the total income or funds available for expenditure through the State highway departments in 1938 amounted to \$1,096,908,000. This includes a balance of \$234,281,000 as of January 1, 1938, and also \$182,355,000 of reserves for debt service.

This is a decrease of \$98,717,000 from 1937.

The total income from State revenue sources was \$817,343,000. This is a decrease of \$18,524,000. The income from gasoline tax was virtually the same in 1938 as in 1937. The auto license fees decreased \$20,000,000. The Federal payments to States were \$67,109,000 less in 1938 than in 1937.

Itemized by sources of income the receipts are as follows: Motor fuel taxes, \$542,638,000; motor license fees, \$256,817,000; motor carrier taxes, \$6,461,000; tolls on bridges, \$4,171,000; State road tax levy (in 5 States) \$489,000; appropriations from State general funds (in 6 States) \$5,489,000 and miscellaneous State fees, \$1,294,000.

The income from other than current State revenue was as follows: Regular Federal payments, \$199,066,000; Federal advance, \$6,640,000; other Federal funds, such as special grants, \$4,400,000; earnings from debt reserve, \$6,582,000; from local government units, \$15,711,000; issue of bonds or notes, \$57,505,000, and miscellaneous, \$2,941,000.

Engineer Warren Resigns

Donald R. Warren, Senior Bridge Engineer in the Division of Highways, is resigning to enter private practice.

During the past few years Mr. Warren has been in responsible charge of State bridge construction in the southern half of the State. Prior to this he assisted in the construction of the San Francisco-Oakland Bay Bridge.

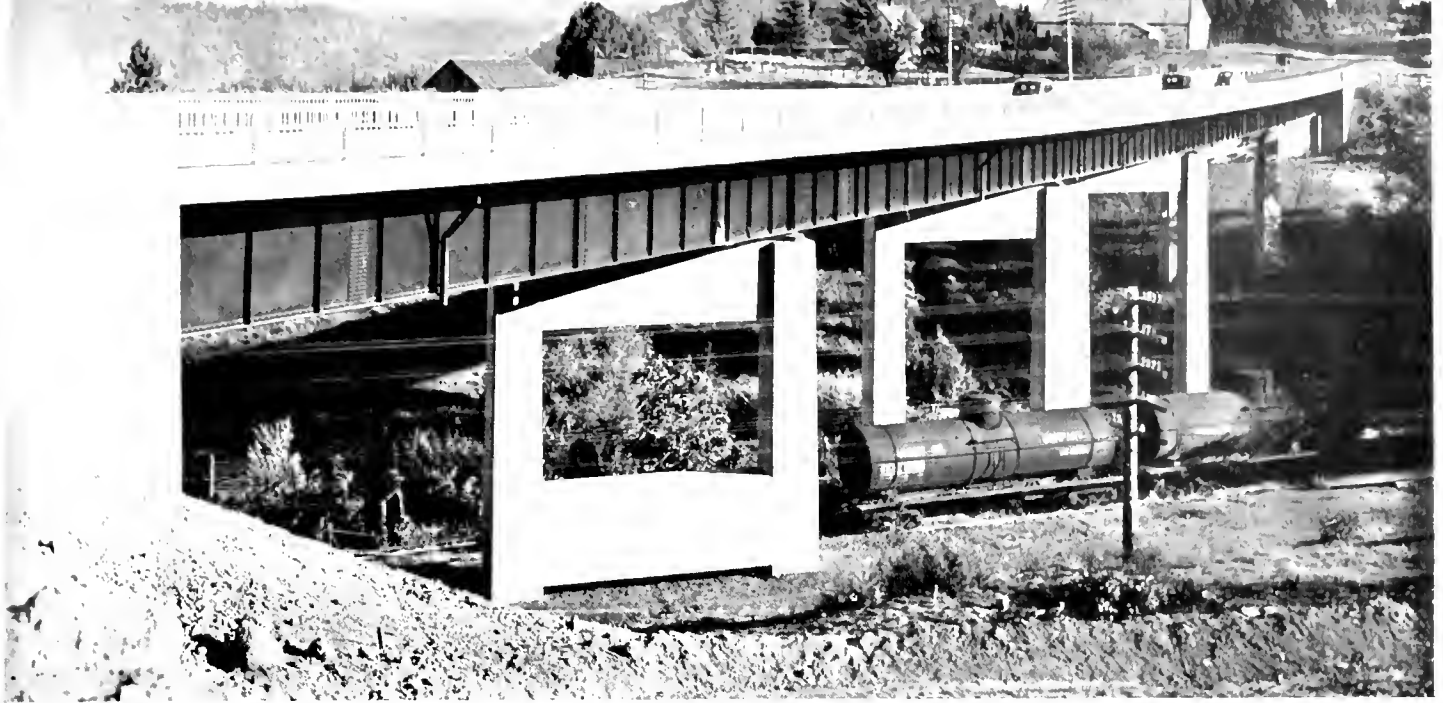
Mr. Warren will establish offices in Los Angeles.

vehicle registrations is thus approximately 1800 per square mile. Populations per passenger car ranges from 3.2 cars per person to 10.4, with the average being 5.6.

Of the 66,000 miles of streets in these cities, one third are unpaved. Motor vehicles per mile of paved street number 183. If all the motor vehicles registered in our largest cities were driven onto the paved streets of these cities at once (a situation with which city drivers may imagine they are familiar) the space allotted to each car would be less than 29 feet.—*Highway Research Abstracts.*

Mistress—Did Tommy get into any trouble while I was gone?

Maid—No, 'ceptin' he swallowed a bug but I give him some insect powder right away.



Recently completed grade separation structure at Colfax, Placer County, carrying U. S. 40 over main line railroad tracks.

Colfax Grade Crossing Eliminated

FINAL work on the overhead grade separation on the new State highway route through Colfax in Placer County has been completed by construction of a permanent connection from the new highway to the city of Colfax.

The overhead structure and approaches were open to traffic last July but insufficient funds made it necessary to confine the work north of the overhead structure to the building of a temporary connection to the old road. Funds for this work were included in the budget for the current biennium and on August 7 a con-

tract was awarded to A. Teichert & Son, Inc., of Sacramento, calling for road construction between the overhead and six-tenths of a mile north.

The type of work specified was the same as on the earlier project except that a greater amount of salvaged surfacing was used in the base, it having been possible to salvage a large percentage of the surfacing from the old road. This job also calls for the reconstruction of a portion of the old road in order to provide a suitable connection from the new highway to the city of Colfax.

On this connection a 30-foot road-

bed was constructed with plant-mix surfacing twenty feet wide and 0.25 of a foot thick on a 21-foot by 0.5 foot base consisting of salvaged surfacing and crusher run base.

The cost of the extension was about \$35,000 and it is now open to public traffic.

The new highway route through Colfax is another important improvement on U. S. 40 between Sacramento and Truckee. The overhead will enable through traffic to avoid the existing main line crossing of the Southern Pacific Railroad and the

(Continued on page 28)



Highway Bids and Awards for the Month of November, 1939

ALAMEDA COUNTY—Between Niles and Farwell, about 0.9 miles to be graded and surfaced with plant-mixed surfacing. District IV, Route 107, Section A. The Utah Construction, San Francisco, \$88,784; Valley Construction Co., San Jose, \$89,995; Eaton & Smith, San Francisco, \$112,483. Contract awarded to Piombo Bros. & Co., San Francisco, \$67,733.50.

AMADOR COUNTY—Two reinforced concrete slab bridges across Jackson Creek and Jackson Creek overflow about 5 miles S.W. of Ione, with overall lengths of 228 feet and 180 feet, respectively, to be constructed. District X, Route 97, Section A. Campbell Construction Co., Sacramento, \$34,340; Caputo & Keeble, San Jose, \$34,922; M. J. B. Construction Co., Stockton, \$34,958; John Rocca, San Rafael, \$35,943; L. P. Tomi, Lodi, \$35,455; Elmer J. Warner, Stockton, \$36,360; A. A. Tieslan, Berkeley, \$36,437; M. A. Jenkins, Sacramento, \$36,988; Albert H. Siemer & John Carcano, San Anselmo, \$37,312; A. Soda & Son, Oakland, \$37,622; Holdener Construction Co., Sacramento, \$38,103; Parish Bros., Los Angeles, \$40,234; Underground Construction Co., Oakland, \$42,844; Valley Construction Co., San Jose, \$44,159; Engineers, Ltd., San Francisco, \$47,912. Contract awarded to Victor L. & Wm. B. Jacobson, Los Angeles, \$33,840.70.

HUMBOLDT COUNTY—Across Klamath River at Orleans, a bridge consisting of a steel suspension span and reinforced concrete approach spans to be constructed and about 0.08 mile of roadway to be graded. District I, Route 46, Sections E, F. Paul J. Tyler, Oroville, \$149,652; John Rocca, San Rafael, \$152,811; A. Soda & Son, Oakland, \$153,674; Fred J. Maurer & Son, Eureka, \$153,111; United Concrete Pipe Corp. & Mercer Fraser Co., Los Angeles, \$158,057; E. E. Smith, Eureka, \$165,152; Hanrahan-Connolly Co., San Francisco, \$168,905; Trewitt-Shields & Fisher, Fresno, \$177,221; Pacific Bridge Co., San Francisco, \$225,223. Contract awarded to C. W. Caletti & Co., San Rafael, \$140,561.

INYO COUNTY—Between 9 miles north of Lone Pine and Independence, about 5.9 miles to be graded and surfaced with plant-mixed surfacing. District IX, Route 23, Section M. Oswald Bros., Los Angeles, \$67,500; G. W. Ellis, North Hollywood, \$69,774; Valley Construction Co., San Jose, \$72,279; Griffith Co., Los Angeles, \$76,561; Gibbons & Reed Co., Burbank, \$77,138; R. M. Price, Huntington Park, \$78,775. Contract awarded to Basich Bros., Torrance, \$60,657.30.

LOS ANGELES COUNTY—On Rosemead Blvd., between Garvey Avenue and Ramona Blvd., about 0.7 mile trees, shrubs, and ground cover plants to be furnished and planted. District VII, Route 168, Section C. Twentieth Century Tree Service, Los Angeles, \$2,619; Peterson Bros., Inglewood, \$4,264. Contract awarded to Jannoch Nurseries, Altadena, \$1,713.90.

LOS ANGELES COUNTY—Arroyo Seco Parkway on Grevelia Street in South Pasadena, between Meridian Avenue and Fairview Avenue, about 0.1 mile to be graded and surfaced with plant-mixed surfacing. District VII, Route 205, Section S.Pas. Edward Green, Los Angeles, \$3,771; Griffith Co., Los Angeles, \$3,835. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$3,635.50.

MODOC COUNTY—Between 3.7 miles north of Rush Creek bridge and Pit River,

First in Registration

Improvement of the State Highway System as a whole has not kept abreast of traffic needs and necessary modernization work will require the expenditure of funds beyond what are now provided.

In this connection it is interesting to note that California ranks first among the States in total vehicle registration and forty-fifth in average motor and gasoline receipts per motor vehicle.

Excerpt from address by Public Works Director Clark.

about 9.2 miles to be graded, surfaced with plant-mixed surfacing on crusher run base. District II, Route 28, Section A. The Utah Construction Co., San Francisco, \$244,093; Hemstreet & Bell, Marysville, \$255,352; Claude C. Wood and Frank B. Marks & Sons, Lodi, \$261,352; A. Teichert & Son, Inc., Sacramento, \$282,843; Isbell Construction Co., Reno, \$291,155. Contract awarded to Harms Bros., & N. M. Ball Sons, Berkeley, \$240,832.55.

MONTREY COUNTY—Across Salinas River at Nacimiento, about 5 miles south of Bradley, a reinforced concrete girder bridge having a total length of 1154 feet to be constructed. District V, Route 2, Section I. J. S. Metzger & Son, Los Angeles, \$217,351; John Rocca, San Rafael, \$219,675; Joseph Shaw, Oakland, \$225,841; A. Soda & Son, Oakland, \$234,726; Earl W. Heple, San Jose, \$236,294; C. W. Caletti & Co., San Rafael, \$257,221; Gibbons & Reed Co., Burbank, \$258,146; Sordal and Bishop, Long Beach, \$269,630; Carlo Longiovanni, Hollywood, \$281,450; Bates and Rogers Construction Corp., Oakland, \$282,698. Contract awarded to Utah Construction Co., San Francisco, \$210,775.10.

SAN DIEGO COUNTY—On Rosecrans St. in the city of San Diego between Lytton St. and Canon St., about 1.9 miles in length, to be graded and paved with asphalt concrete. District XI, Route 12, V. R. Dennis Construction Co., San Diego, \$185,449; Daley Corp., San Diego, \$185,670; R. E. Hazard & Sons, San Diego, \$188,952. Contract awarded to Griffith Co., Los Angeles, \$179,516.10.

SAN FRANCISCO—Between Lake Street and Golden Gate Bridge Approach, in the city of San Francisco, about 1.4 miles in length, to be landscaped. District IV, Route 56. Albert H. Siemer and Roger F. Sohner, San Anselmo, \$41,504. Contract awarded to Leonard Coates Nurseries, Inc., San Jose, \$38,841.75.

SAN JOAQUIN COUNTY—Repairing existing fenders, Middle River and Old River Bridges. District X, Route 75, Section A. Frank Legg, San Francisco, \$7,221; M. Elton, Sacramento, \$8,553; Healy Tibbotts Construction Co., San Francisco, \$8,153; Bundesen & Lauritzen, Pittsburg,

\$8,603. Contract awarded to Pomeroy Sincock, Stockton, \$6,398.60.

SANTA CLARA COUNTY—At University Avenue in Palo Alto, an underpass consisting of reinforced concrete structures and steel beam track spans under the tracks of the Southern Pacific Co. to be constructed. District IV, Feeder road, A. G. Raisch, San Francisco, \$347,753; The Utah Construction Co., San Francisco, \$285,705; Barrett & Hulp, San Francisco, \$285,788; Earl W. Heple, San Jose, \$271,362; Joseph Shaw, Oakland, \$275,097; Eaton & Smith, San Francisco, \$286,131; Engineers, Ltd., San Francisco, \$288,965; A. Soda & Son, Oakland, \$300,678; John Rocca, San Rafael, \$318,707; MacDonald & Kahn, San Francisco, \$343,719. Contract awarded to Paul J. Tyler, Oroville, \$265,960.40.

SHASTA COUNTY—Between Bass Hill and O'Brien Summit, about 4.1 miles, to be graded, portions to be surfaced with road-mix surfacing on crusher run base, a reinforced concrete viaduct 375 feet long to be constructed. District II, Route 3, Sections B, C. Parish Bros., Hollywood, \$333,581; Eaton & Smith, San Francisco, \$340,246; Clarence Crow & L. A. & R. S. Crow, Los Angeles, \$349,029; Maceo Construction Co., Clearwater, \$373,677; A. Teichert & Son, Inc., Sacramento, \$376,328; United Concrete Pipe Corp., Los Angeles, \$386,875; The Utah Construction Co., San Francisco, \$417,926. Contract awarded to Granfield, Farrar & Carlin, San Francisco, \$326,966.

Colfax Grade Crossing Eliminated

(Continued from page 27)

abrupt turns and interference with local traffic in Colfax.

The new route, 1½ miles in length, leaves the existing State highway approximately ½ mile south of Colfax and follows along the east side of that city to a connection with the existing State highway north of Colfax, effecting a saving in distance of 0.2 of a mile.

The cost of the overhead, which provides a 26-foot roadway with a 2-foot, 7-inch sidewalk along each side, was \$117,882.

The realignment of the highway, which was a Federal Aid project, costing \$46,500, provided a graded road-bed 36 feet wide with plant-mixed surfacing 22 feet wide by 0.25 of a foot thick on a crusher run base 23 feet wide by 0.4 of a foot thick.

Scotchman (at riding academy)—"I want to rent a horse."

Groom—"How long?"

Scotchman—"The longest you have. There are four of us going."—*The Watchman-Examiner.*

State of California

CULBERT L. OLSON, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

FRANK W. CLARK, Director of Public Works

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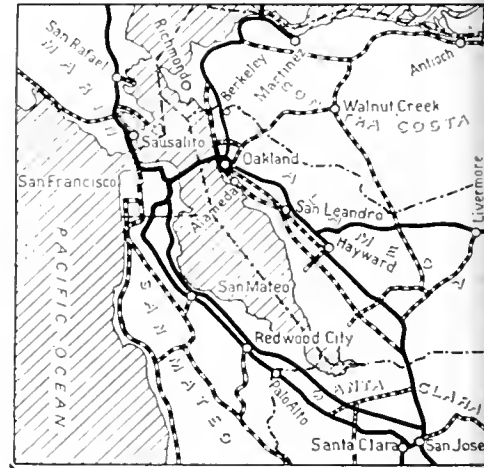
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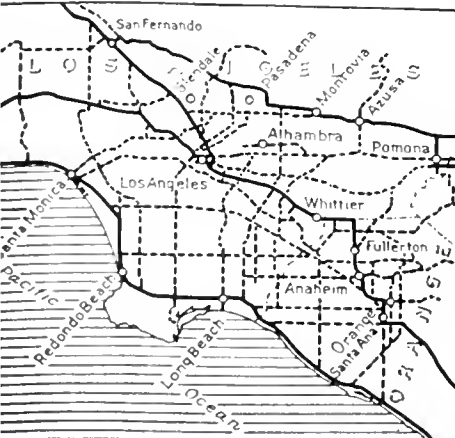
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SHOWING
STATE HIGHWAY SYSTEM

LEGEND

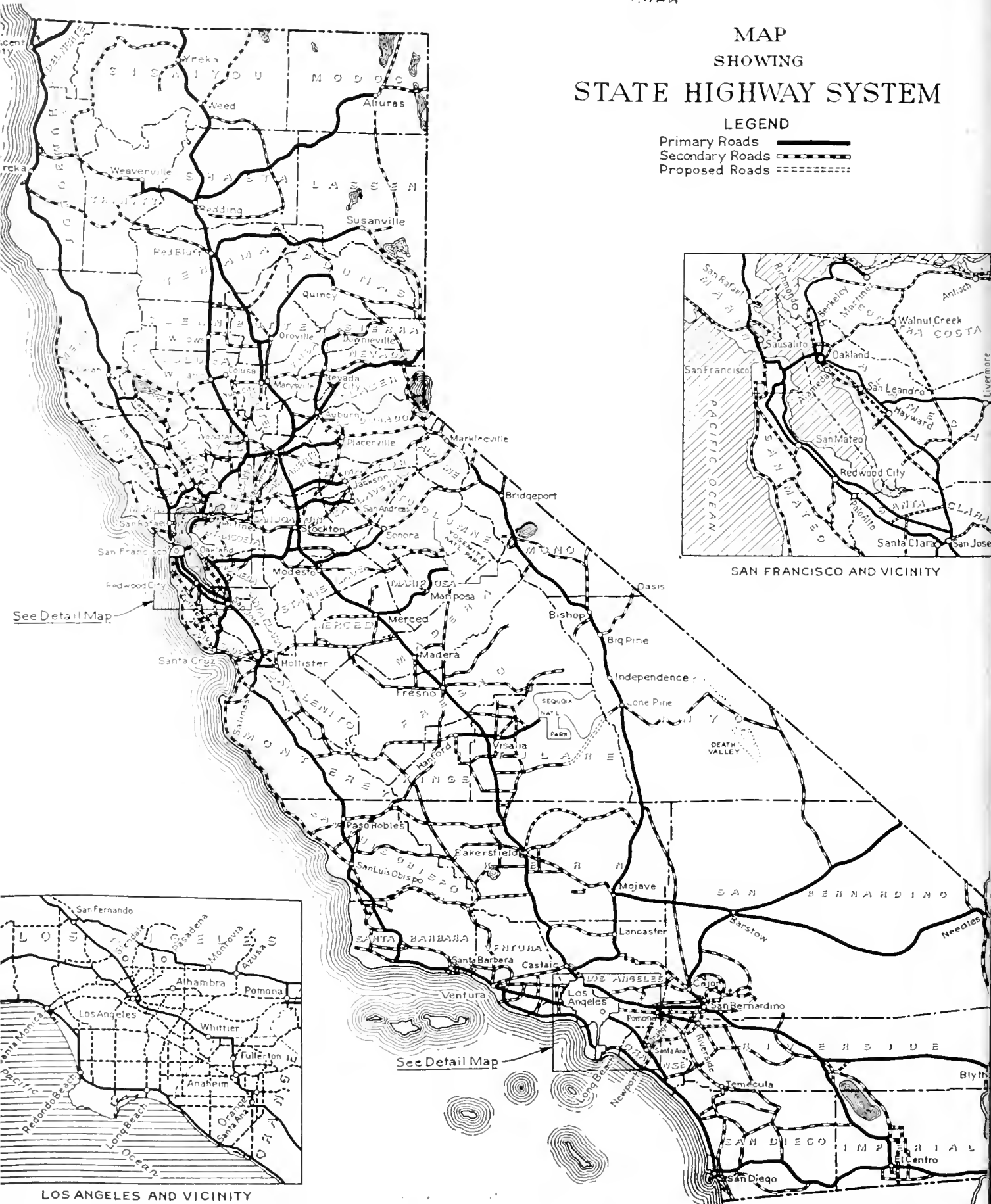
Primary Roads —————
Secondary Roads - - - - -
Proposed Roads
See Detail Map



SAN FRANCISCO AND VICINITY



LOS ANGELES AND VICINITY



CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



Seattle Public Works

JANUARY
1940

NEW 4-LANE DIVIDED HIGHWAY UNIT OF STATE ROUTE 23 ELIMINATING
NEWHALL TUNNEL IN LOS ANGELES COUNTY.

(SEE ARTICLE IN THIS ISSUE.)

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

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JANUARY, 1940

No. 1

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Federal-State Groups Act to Unfreeze \$50,000,000 in Central Valley Project Bonds

LEGISLATION which would enable the Water Project Authority of California to cooperate with the Federal government in the complete development of the Central Valley Project has been presented to Governor Culbert L. Olson and the United States Bureau of Reclamation for their consideration.

The legislation proposed is an amendment to the Central Valley Project Act which would permit the Water Project Authority to issue up to \$50,000,000 of revenue bonds authorized in the act, to be used in performing the purposes and objects of the act approved or requested by Secretary of the Interior Harold L. Ickes. The bonds would be a lien on revenues from the project only and not general obligation bonds of the State.

Federal, State and local representatives joined forces in working out the legislation at a two-day conference held in Sacramento December 21st and 22d. Representing the Federal Government were Walker R. Young, supervising engineer of the Central Valley Project, and R. J. Coffey, attorney for the U. S. Bureau of Reclamation. Public Works Director Frank W. Clark, State Engineer Edward Hyatt and members of their staffs represented the State. Local groups were represented by Governor Olson's Central Valley Project Committee and the Central Valley Project Association.

The meeting was called at the request of Commissioner of Reclamation John C. Page, who urged that the State take the necessary steps to provide public outlet facilities for the project not contemplated by the Bureau of Reclamation. While the bureau is building the major features of the Central Valley Project, it has made no provision for distribution of water and power to local agencies.

Providing this market for the sale of water and power to be developed is of vital importance to the success

Ickes Stresses Need for Legislation

Excerpts from a letter by Secretary of the Interior Harold L. Ickes to Governor Culbert L. Olson read as follows:

"Commissioner Page, of the Bureau of Reclamation, which is building the project, and I, understand the need for such assistance as can be given by the State, in the encouragement of and assistance in organization of both irrigation and power districts. Adequate provisions in State law permitting issuance of revenue bonds to finance the construction of distribution systems afford a convenient and desirable machinery.

"There is no doubt in my mind that the public interest will be served best if publicly controlled outlets for the salable commodities provided by the project are brought into existence. I realize that so far as the power is concerned the supply from Shasta Dam must be supplemented by adequate stand-by capacity if its maximum benefits are to be obtained. * * * *

In my opinion, therefore, the proposal by the State to empower the Water Project Authority to provide these supplemental facilities and to aid in the organization of the public power outlets should be commended and deserves the support of the people of California. Because of the underlying Federal law, such legislation can not unfavorably affect the prospective water users of the project, but on the other hand the provision, as proposed, of a competitive power market should mean actually more favorable rates on the water."

of the project, for the income derived from these sales will have to repay the Federal Government for its cost.

Secretary of the Interior Ickes also stressed the need for State action in providing these markets. He wrote:

"I believe that California can render to the United States a valuable service by undertaking a program which would provide public power outlets for the energy to be generated at the Shasta Dam of the Central Valley Project. The value of the service could be increased by early and vigorous prosecution of such a program as is contemplated."

In presiding at the conference Director Clark, as chairman of the Water Project Authority, made it clear that the State is ready to take such action as desired by the Federal Government, and approved by groups genuinely and constructively interested in the development of the Central Valley Project in all its phases.

"The Federal Government has indicated that legislation should be enacted immediately," Director Clark said. "The representatives of the Federal Government have indicated that now is the time to prepare such legislation if the Secretary's wishes are carried out. The State is anxious to fulfill these wishes and place itself in a position to cooperate with the Federal Government."

Mr. Coffey, as attorney for the Bureau of Reclamation, amplified the position of the Federal Government by stating:

"The Water Project Authority should be in a position to go ahead where the government leaves off. We think you have all the necessary legal power to do what should be done. You need only funds for the Authority to go ahead. I can not say how you should do it. One

way would be to provide revenue bonds."

Starting with this as a basis the conferees worked out the following premise on which the legislation should be designed:

1. That no change in the original intent of the Central Valley Project Act was necessary.

2. That despite Federal financing of the major features of the project the responsibility for providing outlet facilities still rests with the State and local agencies.

3. That means should be devised whereby the Water Project Authority could assist local agencies and co-operate with the Federal Government in financing these outlets.

4. That the best possible method presently available of securing these distribution facilities would be through the issuance of revenue bonds.

It was determined by the conferees that the simplest method of issuing revenue bonds to carry on this work would be to unfreeze a portion of the \$170,000,000 bond issue authorized in the Central Valley Project Act which was approved by a vote of the people in 1933. This act provides for the construction of distribution facilities as well as the major features of the project.

Since the Federal Government has taken over construction of the major features of the project the State revenue bonds have remained frozen because of a section in the act which

provided that the total issue was to be reduced by the amount of the Federal Government's "contribution." Until the amount of that "contribution" is determined bonds provided by the act remain frozen.

The method adopted to overcome this difficulty was the framing of a new section to the act which would release a portion of these bonds. The amendment drawn calls for a ceiling of \$50,000,000 in revenue bonds that can be issued under the new section, leaving frozen in the original act \$120,000,000 in revenue bonds as a safeguard against the failure of the Federal Government to complete the major features of the project.

In order to safeguard those interested in seeing that the revenue bonds be used only for the purposes designated in the Central Valley Project Act, it was also proposed the issuance of these bonds would be only for such works requested or approved by the Secretary of the Interior.

The \$50,000,000 ceiling was determined as sufficient to serve all State needs until such time as the Federal Government makes its final decision on what secondary works will be re-

quired of the State. If pending Federal legislation authorizing the government to finance construction of lateral canals is not approved, approximately half the \$50,000,000 will be available for this purpose. It will also provide funds for the construction of secondary electric distribution lines and a standby steam electric generating plant at or near load center of the Northern California power market.

It was the consensus of opinion of those attending the conference the proposed legislation will meet the sectional objections offered to the Pierovich Bill, defeated at the last session of the legislature. The Pierovich Bill

PUMPING PLANT NO. 4

Initial installation, two 450 h.p. motors and two 250 h.p. motors. Will lift the water 50.5 feet. One 250 h.p. motor to be added.

PUMPING PLANT NO. 3

Initial installation, two 300 h.p. motors and two 150 h.p. motors. Will lift the water 33.5 feet. One 300 h.p. motor to be added.

PUMPING PLANT NO. 2

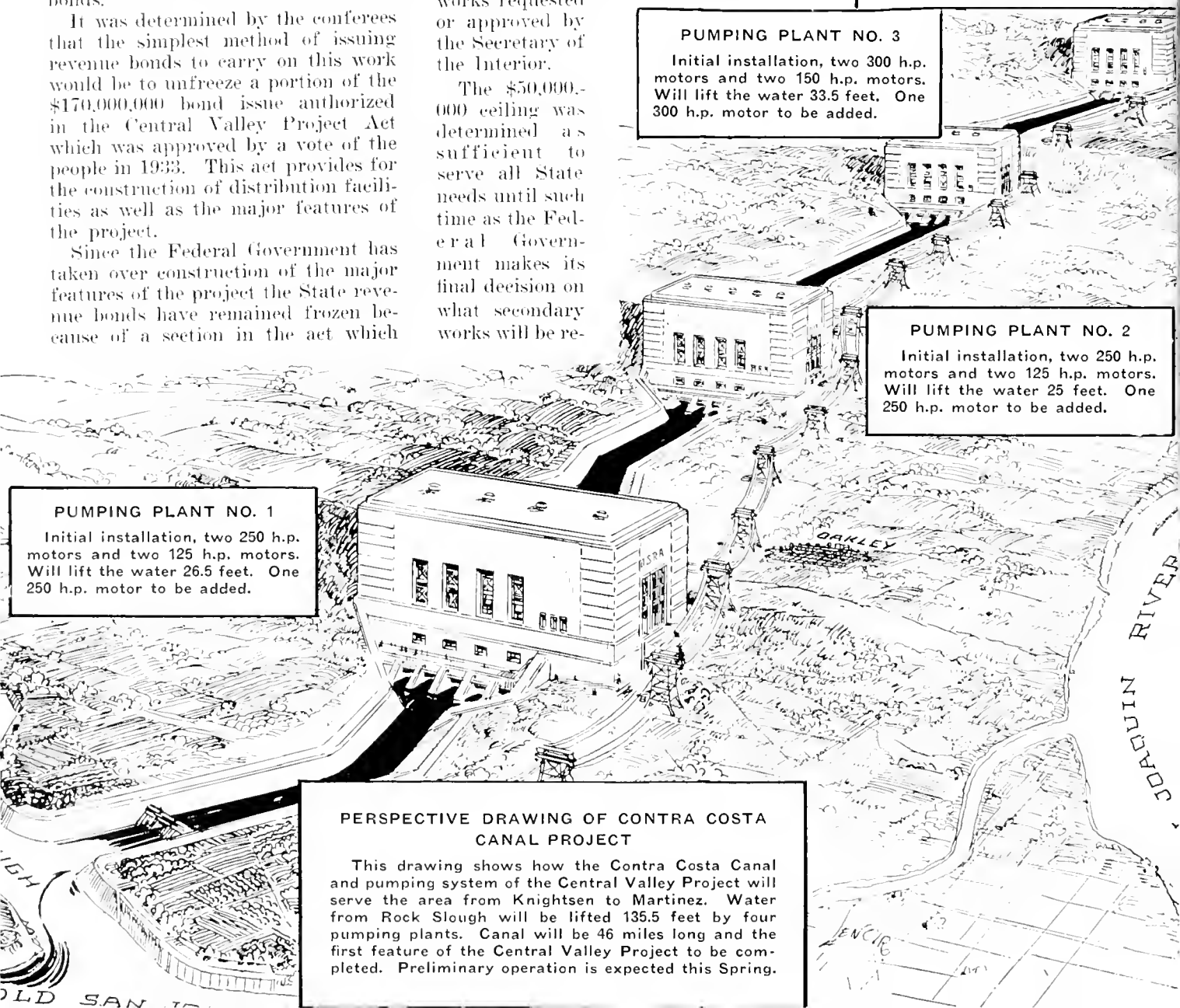
Initial installation, two 250 h.p. motors and two 125 h.p. motors. Will lift the water 25 feet. One 250 h.p. motor to be added.

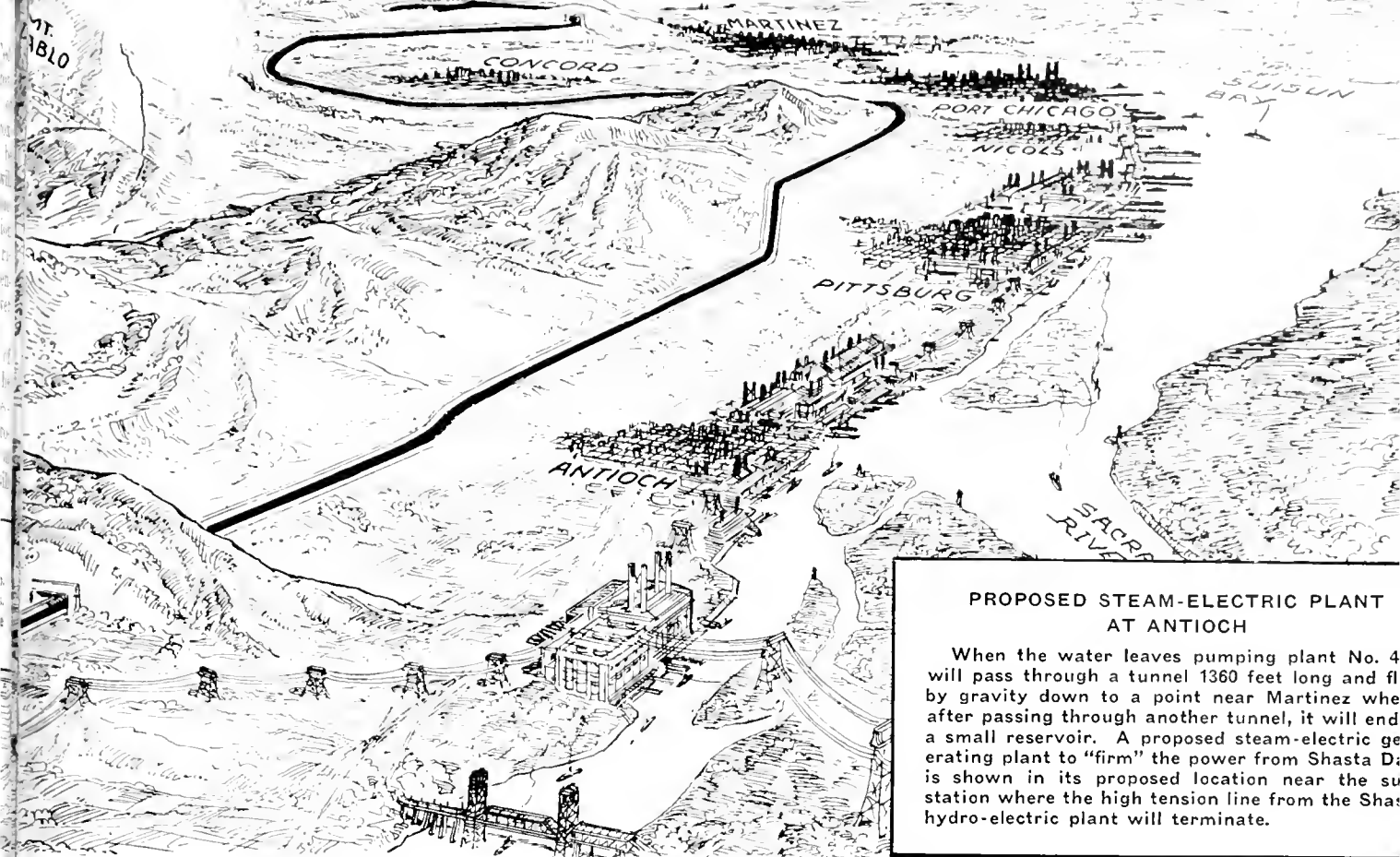
PUMPING PLANT NO. 1

Initial installation, two 250 h.p. motors and two 125 h.p. motors. Will lift the water 26.5 feet. One 250 h.p. motor to be added.

PERSPECTIVE DRAWING OF CONTRA COSTA CANAL PROJECT

This drawing shows how the Contra Costa Canal and pumping system of the Central Valley Project will serve the area from Knightsen to Martinez. Water from Rock Slough will be lifted 135.5 feet by four pumping plants. Canal will be 46 miles long and the first feature of the Central Valley Project to be completed. Preliminary operation is expected this Spring.





PROPOSED STEAM-ELECTRIC PLANT AT ANTIOCH

When the water leaves pumping plant No. 4 will pass through a tunnel 1360 feet long and flow by gravity down to a point near Martinez where after passing through another tunnel, it will enter a small reservoir. A proposed steam-electric generating plant to "firm" the power from Shasta Dam is shown in its proposed location near the substation where the high tension line from the Shasta hydro-electric plant will terminate.

would have unfrozen the entire \$170,000,000 bond issue for use by the State in developing markets for the water and power from the project.

The amendment complies with the request of the Federal Government that the State carry on the work of organizing districts for the consumption of the water and power.

Unfreezing a portion of the revenue bonds voted in the original act rather than authorizing a new issue, does not add to the cost of the project.

Enough bonds are left frozen in the Central Valley Project Act to protect the State against any future needs in completing the project.

Only objection the measure does not meet is that raised by the private power company which is seeking the privilege of marketing all of the power generated at Shasta Dam. The company has opposed any effort on the part of the State to furnish power to public agencies without the company acting as the marketing agent.

At present there are a number of public agencies operating or organized which have indicated their desire to buy the power directly from the State and not after a private profit has been collected by a private

utility. Under the terms of the Federal Reclamation Act and the Central Valley Project Act these public agencies must be given preference in the sale of power developed by the project.

Public Works Director Clark declared he believes passage of the proposed legislation will materially aid California in obtaining further appropriations for the project in Congress. He pointed out that some congressmen already are raising objections to further appropriations for reclamation projects on which provision has not been made for repayment of the money.

"By showing these congressmen that California has placed herself in a position to assist the Federal Government in providing a market for the water and power from the Central Valley Project, we can overcome these objections," Clark said.

In his budget message to Congress President Roosevelt recommended an appropriation of \$16,000,000 to carry on construction work on the Central Valley Project for the next fiscal year. The Bureau of Reclamation asked that \$22,000,000 be appropriated.

To date \$44,600,000 has been appropriated by the congress, but contracts

committing the government to an expenditure of \$73,000,000 already have been awarded. If the \$16,000,000 recommended in the President's budget is not increased it will leave the Reclamation Bureau \$12,400,000 short of its present obligations.

The Water Project Authority, through the State Division of Water Resources, already has done considerable work in providing a market for the water and power from the Central Valley Project. Many irrigation districts have been organized and others are in the process of organization which will use the water developed.

Presently a survey is under way in the area which could be served by a steam electric generating plant to be built at load center near Antioch. It has been definitely determined that such a plant will be necessary to firm the power generated at Shasta Dam in order to operate the system in an economical manner. Construction of the plant was authorized in the original executive order issued by President Roosevelt on September 10, 1935, as an alternative feature of the project suitable for immediate construction. However, funds to build the plant were not made available.

Contra Costa Canal Pumping Plants Near Completion

The Contra Costa Canal, extending from Knightsen to Martinez, will be the first portion of the project completed. The first 20 miles of the canal are virtually completed and bids now are under consideration for the construction of head works at Rock Slough. Four pumping plants which will lift the water to the high-line canal are reported two-thirds complete.

Heafey-Moore Company and Fredrickson and Watson Construction Company of Oakland have started work on an additional nine-mile section of the canal extending from the end of the present work east of Pittsburg to a point two miles northeast of Concord. Only about 17 miles of the 46-mile canal remain on which contracts have yet to be let. However, bids have been called for construction of an additional 8½-mile section which will carry the work on to a point near Walnut Creek.

Arrangements are pending between the Bureau of Reclamation and the Contra Costa County Water District for preliminary use of the completed part of the canal on an interim basis beginning next April. It is planned to serve a number of industries and municipalities with such water as is available.

Regular supply for the canal will come from Shasta Reservoir when that key unit of the project is completed probably in 1944. During the interim, the supply will be of a supplemental nature. When completed the canal will carry 350 second feet of water, which is estimated sufficient to supply all future industrial, agricultural and domestic uses in the district served.

That there will be a heavy expansion of industrial and domestic use of water when the present deficiency is overcome was predicted by George W. Dowrie, Stanford University economist, who made a survey of the district in 1936 for the Water Project Authority. He estimated the increase in water consumption for the area in the next 30 years would be 166½ per cent.

While no recent study has been made by the Water Authority on future power needs in the same area, an expansion comparable to the water

Bids Opened for Madera Canal Unit

An important step towards the delivery of a supplemental supply of San Joaquin River water to the thirsty lands of Madera County was recently taken when the United States Bureau of Reclamation opened 10 bids for the first construction on the Madera Canal, a feature of the Central Valley Project.

The Utah Construction Company of San Francisco and Ogden submitted the lowest offer of \$397,963 for building the first 8½ miles of the canal from Friant to a point just beyond the crossing of State Highway 41 in the foothills east of Madera.

Walker R. Young, supervising engineer of the Central Valley Project, said the upper reaches of the Madera Canal will be 10 feet wide at the bottom and 36 feet wide at the top of the concrete lining which will be 3½ inches thick. With a capacity of 1000 second-feet, it will carry water about 9 feet deep. The first 600 feet of the canal, diverting from Friant Dam, will be built under the general contract for Friant Dam.

The 8½-mile section just bid upon will include three siphons, three highway bridges, seven farm bridges, three overchutes, two culverts, and a wasteway. The construction job will include 580,000 cubic yards of excavation, 22,000 cubic yards of concrete placement, installing 1,770,000 pounds of reinforcement bars and erecting 57,500 pounds of bridge steel. The contractor will be allowed 500 calendar days.

The Madera Canal ultimately will extend a total distance of 40 miles from Friant Dam to Ash Slough, which is a channel of the Chowchilla River in northern Madera County.

consumption might be anticipated with low cost electricity. The area will be within short radius of the termination of the high tension line carrying the energy generated at Shasta Dam to Antioch and thus easily served.

Including the pumping plants for the Contra Costa Canal and the San Joaquin pumping system, which eventually will be served by Shasta Dam energy, there is an available market of more than 500,000,000 kilowatt hours of electricity annually.

Early construction of the planned steam electric generating plant at load center near Antioch will assist in taking care of a portion of this load until Shasta Dam energy is made available and at the same time create a market for Shasta Dam energy.

Improving M^{If pend} Approach Road to Friant Dam

The first fifteen miles of the twenty mile Madera approach road to the Friant Dam is the portion of State Highway Route 126 between Madera and the Fresno-Yosemite Highway.

The Division of Highways, in cooperation with the WPA and SRA, are now reconstructing approximately nine unimproved miles of this route. The completion of this work in the summer of 1940 will place the State highway section of the approach in shape to handle Friant Dam transportation. It is understood that Madera County has completed arrangements for the improvement of the remaining five miles of county road connection to the dam site.

The highway improvement is estimated to cost on a WPA basis about \$240,000. The State Division of Highways is supervising this day labor operation and contributing about \$38,000. The State Relief Administration is participating to the extent of approximately \$18,000 while the WPA cost will be about \$184,000.

The Division of Highways and SRA contributions are being used for the purchase of materials and rental of equipment. Because of these additional funds, it will be possible to operate the project on a more efficient equipment basis instead of the usual relief hand labor methods. Thus the project will not only provide an improved access to the Friant Dam, but will also help the serious relief problem of the San Joaquin Valley. This dual objective was made possible by the fact that state highway funds had been provided under a coincidental budgetary item for a smaller project.

Friant Office Building

The Midstate Construction Company of Fresno has submitted the lowest offer of \$19,319 for building a one-story office structure at Friant for use by the Bureau of Reclamation. The building will be 45 by 102 feet, air cooled and heated. With excavation proceeding at Friant Dam and work soon to start on the Madera Canal, Construction Engineer R. B. Williams' staff at the Government camp has increased to 87, necessitating the additional office building.

Public Works Program Totals Over \$50,000,000 for Next 18 Months

By FRANK W. CLARK, Director of Public Works

GOVERNOR CULBERT L. OLSON'S public building program will make the year 1940 an exceptionally busy one for the Department of Public Works.

Its five Divisions—Highways, Water Resources, Architecture, Contracts and Rights of Way, and San Francisco-Oakland Bay Bridge—constituting the largest agency in State government, will spend more than \$50,000,000 of State and Federal funds during the eighteen months' period that began January 1.

The larger portion of this sum will be expended during 1940.

With the beginning of the new year, there will be bridge and highway construction in the amount of approximately \$27,083,000 to be placed under way during the remaining 18 months of this biennium.

CONSTRUCTION FUND

This work will include construction financed from funds as follows:

Regular Federal Aid	
Feeder Funds and State	
Funds for Current	
Biennium	\$24,366,000
Federal Grade Crossing	
Funds for Current	
Biennium	1,772,400
Remaining Funds From	
Last Biennium	944,600

It is quite safe to assume that during the calendar year of 1940 about two-thirds of this work will be let to contract and placed under way.

In addition, on January 1, there remained some \$9,123,500 for highway maintenance activities during the next 18 months. Approximately two-thirds of this amount will be spent during 1940.

RIGHTS OF WAY

For rights of way and engineering there was on hand at the first of the year for expenditure during the remainder of the biennial period about \$3,936,400.

The sum of \$500,000 has been set aside for maintenance of the San Francisco-Oakland Bay Bridge during 1940.

The Division of Architecture's program for construction, improvement and equipment for the first 18 months of this biennium amounts to approximately \$12,000,000.

Of this amount \$3,061,643 represents work now under way and which



FRANK W. CLARK

will continue to be in the construction field during part of 1940.

New work to be started in the field during the year will amount to \$9,235,400.

WATER RESOURCES PROGRAM

The 1940 program of the Division of Water Resources covers every phase of California's complex water problems from snow surveys and stream gaging through conservation,

flood protection, and distribution, on down to ground water surveys. It includes the administration of all water rights, supervision of dams, flood control and reclamation work, irrigation and drainage supervision, water resources investigations, the Central Valley Project and cooperative work with the Federal government.

As a result of the passage and signing by Governor Olson of Senate Bill 950, the Sacramento Valley will have for the first time an adequate flood control maintenance program. The Division will spend \$1,020,000 in State and Federal funds, \$695,000 of which will be for permanent bank protection at 47 places along the Sacramento River and the remainder for levee work and clearing flood channels of vegetation. An additional \$55,000 will be spent on extension of the Russian River Jetty.

In connection with the Central Valley Project, on which the Federal government has awarded contracts amounting to approximately \$75,000,000 to date, the division will continue engineering, legal, economic and financial studies relative to the disposal and utilization of the water and power to be developed. About half of the \$100,000 provided for these studies will be spent in 1940.

DAMS AND FLOOD CONTROL

During the year the Division will inspect each of the 618 dams under its jurisdiction, supervise repairs and alterations made on these dams and supervise all new construction and enlargement of dams undertaken during the year.

Repair of damage caused by the floods of 1937-38 in 51 counties, for which \$5,000,000 in emergency funds was voted by the legislature, will be completed in 1940. Between 175 and 200 contracts have been let and reconstruction still is under way on about 40 of them.

(Continued on page 13)



Portion of recently completed section of State highway realignment through Tehachapi Pass between Bakersfield and Tehachapi.

Tehachapi Pass Unit Opened

By JESSE W. COLE, Resident Engineer

A RECENTLY completed stretch of highway 4.6 miles in length on State Highway 58 as a part of the reconstruction of the important Tehachapi Pass route between Bakersfield and Tehachapi has resulted in a great aid to motorists. The section just completed extends from Bear Mountain Ranch to one mile north of Keene.

This short stretch of new highway has eliminated many steep grades and sharp radius curves. A twenty-eight foot minimum width of traveled way replaces the sixteen foot width along the old route.

The new work has been built to modern standards for the volume and type of traffic using this highway through the canyon. On the old route there were curves with radii as short as 50 feet, while on the work just completed the minimum radius is 1000 feet. The grade line has been flattened from a maximum of 7.5 per cent on the old road to a maximum of

6 per cent on the new. The minimum horizontal sight distance has been increased from 50 feet to 400 feet and vertical sight distances lengthened from 100 feet to 600 feet.

SAVINGS TO MOTORISTS

Construction operations on the 4.6 miles involved nearly 500,000 cubic yards of roadway excavation. In construction of the surface about 655 tons of liquid asphalt was mixed with the roadbed material over a total area of 79,500 square yards. In providing adequate drainage facilities some 4760 linear feet of various sizes of corrugated metal pipe were used.

Because of the higher standard for both grades and alignment, trucks are now able to reduce their traveling time between Bakersfield and Tehachapi by as much as from 20 to 40 minutes. While the stretch of highway recently completed is short, it will give some idea as to the tremendous saving to motorists, particu-

larly to those operating heavy trucks, that will be accomplished when the entire stretch of U. S. 466, between Bear Mountain and Tehachapi, is completed.

Traffic over this route is continuously increasing, especially by out-of-State cars and heavy trucks. A large cement plant east of Tehachapi hauls by truck a great portion of its product to various points in the metropolitan area of Los Angeles over this route as well as throughout the San Joaquin Valley.

GREATLY INCREASED TRAFFIC

During the past five years the week day traffic has increased 148 per cent. During the wild flower season this highway carries a daily flow of traffic reaching nearly 4,000 vehicles.

The construction of another section, 4.3 miles in length, between the easterly end of the work recently finished and a point opposite Marcell is now in progress.

This new location, however, provides for construction along the northerly side of the Southern Pacific Railroad. The new alignment across the railroad from the existing road together with the fact that the new road is kept at a much lower elevation, will greatly improve conditions from the standpoint of snow removal.

Along the present highway the road has a north exposure and reaches elevations three or four hundred feet higher than the new location. Much difficulty is had during the winter snows.

When other transcontinental routes farther to the north are closed, the new Tehachapi Pass Road will remain open to all-year traffic.

The original road through the pass was a wagon trail built during the mining excitement caused by the discovery in 1870 of silver in the Panamint Valley just west of Death Valley. Los Angeles was doing a thriving business by wagon trains with the prosperous Panamint camp area and the railroad was pushed south through the San Joaquin Valley as far as Bakersfield to participate in that business.

The nearest feasible route for the wagons to the new rail terminus was through Tehachapi Pass branching off at Mojave from the Panamint route to Los Angeles.

Views of improved sections of Tehachapi Pass widened from 16 to 28 foot width of traveled way eliminating many steep grades and sharp radius curves.



Administrative Problems of State Highway Maintenance

By T. H. DENNIS, Maintenance Engineer

Following is the first installment of an address delivered by Mr. Dennis at the recent meeting of the State-Wide Highway Committees of the California State Chamber of Commerce at the Palace Hotel in San Francisco.

MAINTENANCE of the State Highway System more closely touches the life of the State than almost any other phase of public work. The system extends into every major community.

Members of the maintenance organization are in daily contact with traffic needs, and with local problems and emergencies. The work involves a great amount of detail, and requires careful planning. It can be best understood through presentation of such detail. Before entering into a discussion of the subject, it is desirable to outline the extent and use of the highway system so that the problem may be better visualized.

There are 13,657 miles of traversable road in the system. This includes 1035 miles of through city streets. This mileage is all main-

tained by State forces, with the exception of 687 miles of city streets located mainly in the larger cities.

The field force engaged in maintenance work consists of some 2557 men, including superintendents, timekeepers, bridge and ferry tenders. The territory assigned varies with the extent of work. On the average, each superintendent is in charge of about 240 miles of road, and a foreman and crew is assigned 40-mile sections. Excluding supervision, this is equivalent to an average of one man to each $5\frac{1}{2}$ miles of road maintained.

For administrative purposes, the system has been divided into some 1300 sections. These sections have been designated arbitrarily on a geographical basis, but in general it may be said that each section represents

an individual problem of maintenance. The type and standard of improvement; the age, soil and climate; and the volume and composition of traffic are all factors which must be considered.

There are approximately 6,825,000 vehicle miles generated annually on the rural State Highway System. The average daily density of traffic is 1485 vehicles per mile of road. About 15 per cent of the annual vehicle mileage is generated by commercial vehicles. It is to be noted that the term "rural State highway" is merely a reference to the location of the road rather than the traffic. The traffic itself is predominantly of urban rather than rural origin.

Traffic of urban origin on the rural State Highway System is very large near the great centers of population,

The mileage by type of surface and the traffic range and average traffic on the rural State Highway System is shown in Table 1.

TABLE 1

Miles of Rural Road by Surface Types, Number of Lanes, and Traffic

TYPE OF SURFACE	MILES BY NUMBER OF LANES				TRAFFIC	
	Two	Three	Four	Total	Range in traffic vehicles per day	Average daily
Bridges (all types).....	76.169	3.643	8.640	88.452	100 to 20,000	2,327
Dual or Divided (miscellaneous types).....	40.269	43.370	47.111	130.750*	2,500 to 20,000	6,414
Brick	0.550			0.550		871
Portland Cement Concrete.....	1,574.901	170.473	107.465	1,852.839	500 to 20,000	3,369
Oiled Concrete	285.562	.348	0.267	286.177	250 to 7,500	1,925
Asphaltic Concrete	1,099.727	138.793	65.641	1,304.161	500 to 20,000	3,266
Bituminous Macadam	968.829	11.990	18.718	999.537	250 to 7,500	1,541
Plant Mix	1,317.383	14.587	11.191	1,343.166	100 to 5,000	1,329
Road Mix	1,883.958	1.170	1.923	1,887.051	Up to 5,000	671
Oiled Gravel	1,593.291		0.357	1,593.648	Up to 2,500	681
Oiled Earth	2,641.889	1.550	0.392	2,643.831	Up to 2,500	333
Gravel	29.557			29.557	100 to 250	
Earth	460.300		1.474	461.774	Up to 250	131
Total	11,972.385	385.924*	263.179*	12,621.488		1,485
Miles of city streets maintained by State forces.....				348.078		
				12,969.566		
Miles of city streets maintained by city forces.....				687.326		
Total mileage in system as maintained.....				13,656.892		

* The 130 miles of dual or multiple lane roads is equivalent to nearly 200 miles of two lane road from a maintenance point of view. The 649 miles of three and four lane pavement is equivalent to some 1,100 miles of two lane surface.



Winter Failure of Light Surface North of Quincy, Feather River Route, from Storm and Traffic Conditions.

constituting over 80 per cent of the vehicles. The rural State highways are frequently considered as connecting links between cities, but in many cases it is equally appropriate to consider them as extensions of city streets.

Only in the more isolated sections do the urban-owned vehicles drop below 60 per cent of all vehicles, and in all cases urban vehicles are over 40 per cent of the total, even in such counties as Trinity, Plumas and Alpine, which have no incorporated municipalities.

CONDITION OF FACILITIES

The condition of highway facilities is changing constantly. Considerable sums are being expended for major improvements and for a certain amount of reconstruction. In any one year only a small percentage of the system is so improved.

It has been estimated that twenty-five years will be required to complete desirable improvement work on the system at the present rate of progress. In the meantime, the present facilities must be kept in condition to carry traffic or restrictions placed on normal operation. A portion of the bridges, for example, were not designed originally to carry loads which are legal under present laws. Others have deteriorated to an unsafe condition. The

same is true of certain sections of road.

The condition of the bridges is indicated by Table 2.

TABLE 2

Condition of Bridges

Number posted for restricted loading as of Dec. 1, 1939.....	369
Number considered inadequate because of narrow roadway (less than 20 feet,	682
Number considered inadequate because of restricted overhead clearance	29

There is an overlapping as to width, vertical clearance and condition, but

taking the structures as a whole, it appears that approximately 27 per cent are inadequate for one reason or another. There is frequent damage to structures because of accidents resulting from deficiencies in clearance. The main expense, of course, is on the 11.7 per cent which are obsolete due to age or inadequate design.

A review of the road surfaces by types indicates deficiencies as to thickness, width and type of surface for the traffic served. The extent of these deficiencies is indicated in Table 3.

Deficiency as to type, width, or thickness of road surface for the vol-

TABLE 3

Deficiencies in Road Surface

Type of Surface	Miles Deficient	Daily Traffic	Type of Deficiency	Desirable Standard for Volume of Traffic
Portland Cement Concrete	900	1,000 to 10,000	Less than 6 inches thick	6 inches x 9 inches 22 feet wide
Oiled Gravel.....	332	1,000 to 5,000	Too low type	P.M.G. or high type pav't
Oiled Earth.....	505	500 to 2,500	Too low type	P.M.G. or R.M.G.
Earth	220	100 or more	Too low type	Oiled earth
All Types.....	6,549		Less than 20 feet wide	20 feet to 22 feet width

une of traffic results in greater maintenance expense. For each year that such deficient facility continues in service, more careful attention must be given, with a corresponding increase in expenditures. This is particularly true in the case of deficiency in width. Where the width is less than 20 feet, shoulders require more than ordinary attention to insure essential pavement support and traffic protection. As indicated in Table 3, this problem is acute on 6549 miles or 51.8 per cent of the rural State Highway System serving 27.8 per cent of the traffic.

LIFE OF SURFACE

A matter of concern is the increasing tendency, due to a lack of funds, to substitute a lower standard of surface than that which the traffic requires. In addition to items in Table 3, for instance, there are 1975 miles of plant or road mix carrying a daily traffic of from 500 to 10,000 vehicles a day. Two hundred and five miles of this surface type is now carrying a volume of traffic which is almost twice that of the average density for the entire system.

While it is impossible at this time to estimate the span of life of this surface, it is entirely reasonable to assume that its economic life will not exceed ten years. Since the average age of this type of surface is now approximately five years, it follows that unless replacement is commenced during the next five years, its maintenance will increase.

In a progress report to the Highway Research Board which was received early this year, H. K. Bishop, Chief of the Division of Construction of the Public Roads Administration, who acted as chairman of the subcommittee on Maintenance Costs, furnishes data on the cost differential between adequate and inadequate surfaces; and also between surfaces of adequate and inadequate width.

COST OF SURFACE

In the Pacific States group, it was observed that the cost of maintaining surface only was \$126 for high type pavements and \$219 for intermediate type pavements, carrying from 751 to 4000 vehicles daily. It is to be noted that the high type pavement, despite its lesser annual maintenance cost, was given a higher condition rating than the intermediate type



Failure of Red Bluff-Susanville Route Due to Inadequate Base.

surface. These figures were for surfaces 20 feet wide. A similar, though less pronounced, differential exists in the case of surfaces less than 20 feet in width.

Again, taking the same traffic group and considering high type pavements, the cost of maintaining traveled way was \$169 for 18-foot surface and \$126 for 20-foot surface, and moreover the lesser expenditure produced a higher condition rating.

MAINTENANCE COSTS

The report concludes that "Surface maintenance costs are lowest for the high-type pavements—durability being built into the surface; increase for intermediate types, and are the highest for low-type surfaces." And, "Surface maintenance costs are generally lower on 20-foot widths of surface than on 18-foot widths. The 20-foot widths have less pavement edge failures and water seepage under surface through rutty shoulders."

The committee also states "Surface maintenance costs increase with increase in traffic on specific types of pavement. Weight of traffic further increases cost, but more data are desirable to determine extent."

The foregoing comments serve to present the size of the maintenance problem and some of the specific conditions with which the maintenance organization is faced.

We come now to the question of standards of maintenance. In California, it has been the policy to provide funds to insure an adequate but

not an unusually high standard of maintenance. In this regard, it is interesting to note a comparison of maintenance costs in California with those in other parts of the United States.

The H. K. Bishop report previously mentioned covered maintenance costs over a three-year period on 1233 sections representative of the principal type surfaces in use, covering 18,716 miles of highway in 47 states. The sections selected were of standard construction and adequate for the traffic served.

Early this year a report was issued showing a compilation of these data. This report shows that the average annual maintenance cost in the four groups of Eastern States, which compare in traffic volume with the Pacific States group, was \$537 per mile. The average annual cost for the Pacific States group was \$436 per mile.

The sections in California included some 361 miles scattered throughout the State, which were representative of surface type, climatic and average traffic conditions. The average cost for these sections was \$460 per year per mile.

A comparison of maintenance cost items between the selected standard sections and the rural entire State Highway System is shown in Table 4.

The routine maintenance of \$413 per mile includes provision for operation of movable span bridges, highway lighting, operating expense and lighting of two tunnels, operation of two ferries, and similar work not

directly connected with upkeep. The net amount estimated for routine work is \$400 per mile.

TABLE 4

Comparison of Average Maintenance Cost per Mile

Item	For selected sections	For entire State Highway System on basis of present budget
Routine Maintenance	\$223	\$413
Replacements	70	135
Improved Service	132	83
Major Slides and Repair of Storm Damage	35	80
Total	\$460	\$711

The main difference between the cost on selected sections and state-wide average is reflected in the Routine Maintenance. This condition is to be expected, since the sections for which costs were reported are of fairly recent construction, and with surface and other facilities designed for the existing traffic. The cost of this Routine Maintenance should approximate the minimum for the particular traffic volumes. The cost of "Improved Service" as shown in the following table is higher than

the State Average. This, also would be expected. A review of the several classes of work which entered into this charge as shown in Table 5 is interesting.

TABLE 5

Detail of Improved Service Charges

Item	Cost per Mile
Upkeep of guard rail	\$7.00
Cutting and control of roadside vegetation	34.90
Care of plantings	30.77
Care and installation of highway markers	6.65
Traffic Striping	25.46
Snow removal	18.13
Miscellaneous items	9.09
	\$132.00

When viewed in detail, it is apparent that no single item is excessive if a good appearance and proper service is to be assured. The item for snow removal is low, as only about 50 miles out of the 361 miles of the selected sections are in territory where snow removal is required each season, and the fall is comparatively light.

The cost of major slide removal and repair of storm damage likewise is lower on the selected sections than the State average, as they are located

in areas where such damage seldom occurs.

The Bishop cost report referred to above also included a condition rating for the model sections. The Pacific States group, including California, was given a condition rating of 93 per cent. This compared with a rating which ranged from 88 to 94 per cent for other sections of the country. Taking this into account along with the favorable cost comparison, it appears that maintenance work in California is on a reasonable par with other sections of the United States.

This is the first installment of Mr. Dennis' address. The second installment will appear next month. Editor.

2,191,683 Autos Delivered

In the first ten months of 1939, 2,624,738 motor vehicles were delivered to consumers, an increase of 46 per cent over the same period in 1938. Of this number, 2,191,683 were passenger cars, representing a gain of 48.8 per cent; and 433,055 were commercial vehicles, representing a gain of 35 per cent.

"My girl friend has a wonderful new job now, doing settlement work."

"Settlement work?"

"Yes, her lawyer sues, and she gets the settlement."



Typical Slip-out During Heavy Storm on Topango Canyon Route Near Santa Monica in Los Angeles County.

Modern Psychiatric Clinic Unit to be Added to U. C. Medical School

By P. T. POAGE, Assistant State Architect

THE popular conception of mental disorder or disease is generally accompanied by a feeling of horror and hopelessness. Up to comparatively a few years ago, persons so afflicted were isolated in "asylums," usually for the remainder of their lives, where a low standard of living, general neglect, and often mistreatment were designed to increase rather than lessen the effects of the mental disorder.

As medical science progressed and the public became more conscious of its responsibility to those suffering both physically and mentally, there gradually evolved first the hospital in which proper care and safe custody were the prime factors, followed by further steps to the present time in which special attention is being given to research for determining causes, and to treatment for effecting cure and rehabilitation to society.

In dealing with this phase of the problem, California has long been at the front, both in the work done in its public institutions and in that performed by psychiatrists in private practice. Under the leadership of Dr. Aaron J. Rosanoff, Director of Institutions, it is now preparing to take the lead in this field with the construction of a new specialized Psychiatric Clinic to be constructed by the Division of Architecture for the Department of Institutions in San Francisco.

\$500,000 APPROPRIATION

Dr. Rosanoff has given a lifetime to the study of this problem and is a nationally recognized leader in the field and the author of numerous books widely read wherever psychiatry is considered. His familiarity with the results to be obtained by proper application of existing knowledge and his enthusiasm for research and the development of a greater understanding of the functions of the human mind were effective in convincing Governor Olson and the Leg-

islature of the urgent need for a proper plant in which to carry on this work. As a result, there is now available an appropriation of \$500,000 for this purpose.

In the furtherance of this project, in July, 1939, Dr. Rosanoff, W. B. Reynolds of the University of California, and P. T. Poage, Assistant State Architect, visited approximately twenty of the important centers of psychiatric research and treatment in eastern cities, including Madison, Wisconsin; Chicago, Toronto, Boston, New York, Baltimore, Philadelphia and Pittsburg. Detailed inspections were made of the physical plants and consultations held with the directors and other staff members of these specialized hospitals and clinics.

COOPERATING WITH MEDICAL SCHOOL

The site for the new unit is on the property of the University of California Hospital and Medical School facing Parnassus Avenue. Careful attention is given to coordination with the future development of the Medical School whose interests in the teaching and study of psychiatry are tied closely to those of the Department of Institutions. This strategic location is of mutual advantage to the university and to the Department of Institutions in giving to the latter the full advantage of ready access to the specialized staff, laboratories, and other facilities of the Medical School; and offering to the university the best of facilities for study and research in advanced psychiatry.

As this is written, late in December, 1939, the preliminary plan has been agreed upon and working drawings and specifications will proceed as rapidly as the details can be developed to meet the approval of the consultants in the various branches of the work to be housed.

The basic architectural character is drawn from the designs of the University architect for the proposed main unit of the Medical School which will

be the dominating mass of the entire hospital and medical group when constructed, and of which the Psychiatric Clinic will, in effect, be one wing. The accompanying perspective sketch shows in tentative form the general mass of the design in its present stage of development.

TWO GARDEN AREAS

The plan form is that of an unsymmetrical "T." Two garden areas occupy the space on either side of the stem of the "T," one giving special interest as an entrance feature exposed to the view of the main street, and the other a secluded area protected from the public view to provide outdoor recreation area for patients under treatment and observation.

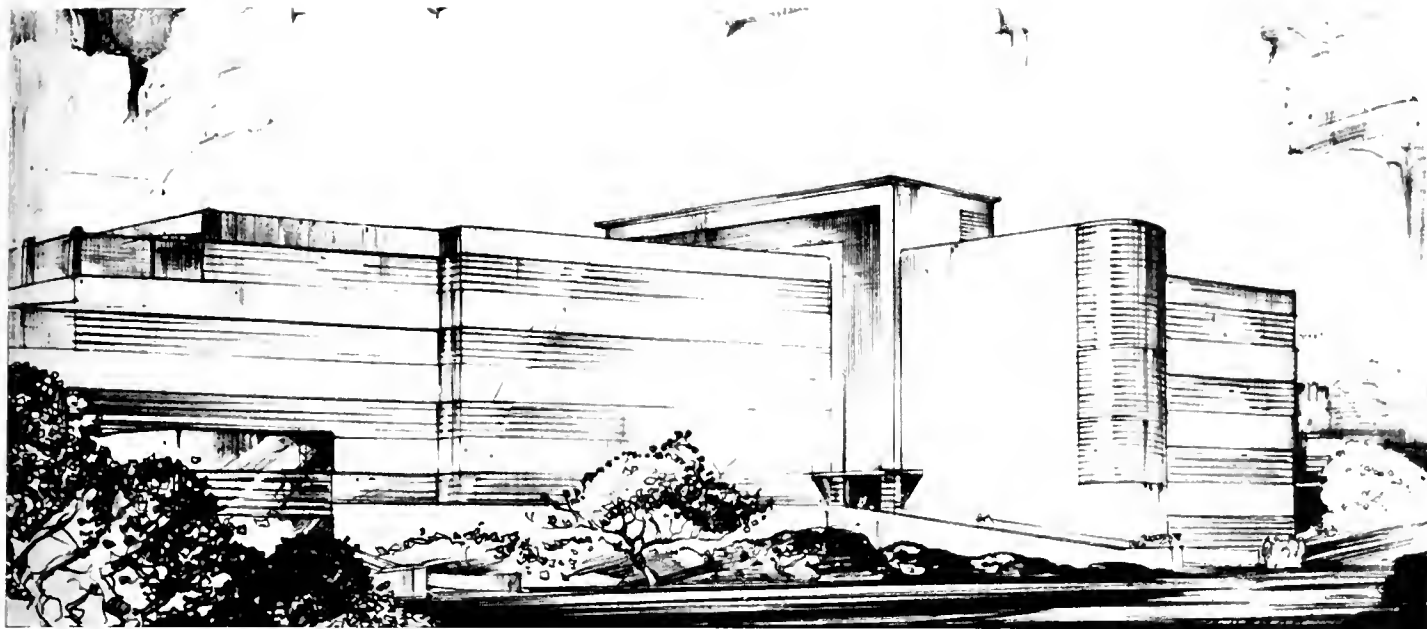
The main mass of the structure will be four stories high. Additional area for necessary service units and storage will occupy a partial basement. The elevator pent house, living quarters for resident physicians and other minor elements will be housed in a central fifth floor unit.

The first floor will be given primarily to the out-patient department, administrative offices, receiving unit, laboratories, and lecture room.

HOUSES 100 PATIENTS

The principal areas on the second, third, and fourth floors are devoted to housing approximately 100 patients divided equally between the sexes. Distinct separation of sexes is provided, except in the neuro-surgical and the children's wards.

On the extreme front wing of these three upper floors are specialized units including: (1) Facilities for insulin shock therapy, a treatment giving excellent promise in the cure of cases not too far advanced; (2) a complete neuro-surgical unit with operating room, X-ray, and related accessories to care for all surgery of the brain and the nervous system; (3) occupational therapy rooms devoted to craft work designed to oc-



Sketch of proposed psychiatric clinic to be built at the University of California Hospital and Medical School in San Francisco.

occupy the mind, develop coordination of faculties, and otherwise improve the general mental condition.

The new clinic is intentionally limited in size, being considered not as a basic treatment unit, but as a center from which will be directed an increasingly broader program of practical applied psychiatry to be carried out by the various institutions already in existence.

STUDY OF MATERIALS

A careful study has been made of types of material best adapted to the special service required in this type of hospital. Construction will be of reinforced concrete in so far as the principal structural frame is concerned and other materials will in general be fire resistive to provide the fullest protection to the patients.

Acoustic materials will be used extensively to minimize noise disturbances. Adequate natural light and ventilation will be available generally through the generous window area characteristic of the modern architectural treatment.

The Division of Architecture is happy to have a small part in bringing this important service to humanity.

"Since I've stopped going around with college boys, I'm three pounds lighter."

"Do you mean you're worrying and losing weight?"

"No, I've given back all the fraternity pins I've been wearing."

Public Works Program for 1940

(Continued from page 5)

The Division will continue the supervision of irrigation districts and lend assistance to the District Securities Commission in refinancing and refunding old bond issues. Seventy-three districts with a total of \$89,500,000 in outstanding bonds come under this jurisdiction.

In the water rights section applications for permits to appropriate water for the year 1940 will approximate 350. It is estimated that 225 of these will be approved, that rights will be confirmed by issuance of licenses in 110 cases. Approximately 275 inspections and field investigations of water rights will be made.

WATER ADJUDICATION

The Division will complete the adjudication of water in five districts including the large Middle Fork of the Feather River district and the North Fork of the Pit River district; and in the smaller districts of Ash Creek in Big Valley, South Cow Creek and the Raymond Basin Area Reference. Two new water master districts will be created in addition to the 14 now in existence.

Cooperative work with the Federal government on which the State and Federal government share the expenses equally will include stream gaging, at a cost of \$50,000; topo-

graphical surveys, \$10,000; irrigation investigations, \$10,000; and other co-operative work with the War and Agriculture Departments on state-wide flood control investigations.

On small surveys the Division will spend \$7,500 and supervise the work of several cooperative agencies both public and private which will spend an additional \$30,000.

Under miscellaneous projects the Division will dredge Mission Bay at San Diego at a cost of \$30,000; prepare plans for a water supply for the State institutions in Napa Valley and continue the South Coastal Basin surveys.

Six Trucks Move 150-Ton Gun

One of the heaviest loads ever hauled over a road on this continent was moved to Fort Cronkite, California, recently when a 16-inch gunbarrel weighing 150 tons was transported with four trucks pulling and two trucks pushing.

The six trucks, generating 900 horsepower, moved the hauling unit, with forty wheels under it, at a rate of one and one-half to two miles per hour.

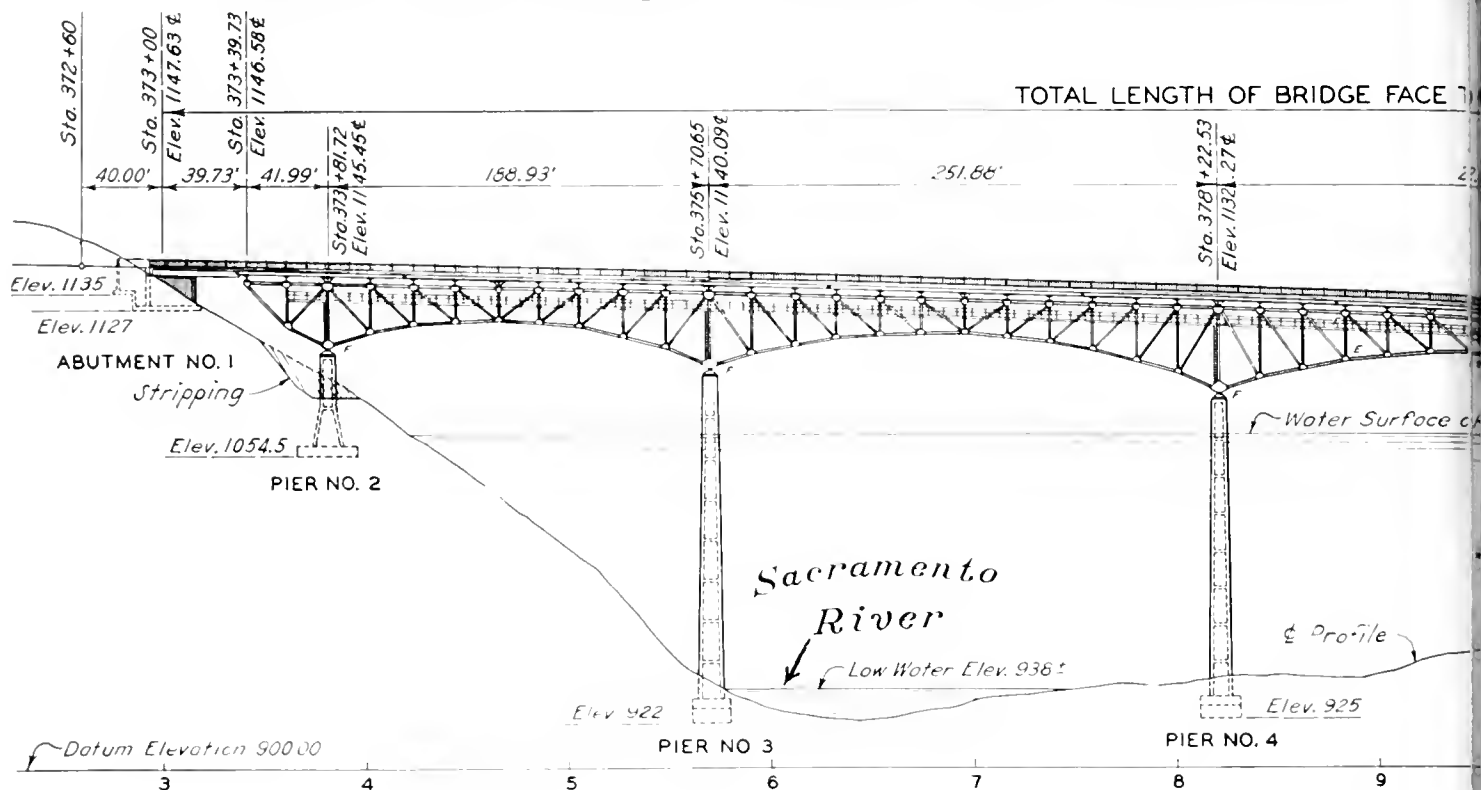
The incident demonstrates once more that highways are vital in national defense.

"Who is that terribly homely man sitting over there?"

"That's my brother."

"Pardon me. I hadn't noticed the resemblance."

Steel Truss Bridge at Antler Will Carry Four-lane



By GLENN L. ENKE

A FOUR-LANE highway relocation project across the proposed Shasta Reservoir is the 1330-foot steel and concrete bridge now under construction over the Sacramento River near Antler, about 14 miles above Shasta Dam. At that point, the reservoir will be 150 feet deep, and the water surface will be more than 100 feet above the present stream in the Sacramento River Canyon.

As the new highway approaches the south end of the bridge location on a long 6 per cent descending grade, at a sharp angle to the structure, it was necessary from a safety standpoint to locate the entire bridge on a 5000 foot radius curve with an 850 foot curved approach highway. Smooth transitions between the various radii will provide safe and comfortable automobile travel at all times.

The bridge is laid out with five major spans: two of 189 feet, two of 252 feet, and one central span of 273 feet. Forty-two foot cantilever spans at each end support short beam spans that serve to distribute and

minimize the effect of structure deflection or of settlement of the approach fills.

TWO SIDEWALKS PROVIDED

A 50-foot roadway is provided, with two narrow sidewalks and steel railing. Two lines of steel deck trusses 31 feet apart support floorbeams at each 21-foot panel point, nine lines of steel stringers, and a reinforced concrete roadway slab 7 $\frac{1}{4}$ inches thick.

The main piers are eight feet wide at the top, 40 feet long, and of varying heights, the tallest being 172 feet above its rock foundation.

PIERS OPEN TO WATER

Piers are of cellular construction, using 18 inch walls and interior ribs throughout. Varying amounts of reinforcing steel in these walls provide for the differences in stress at the proper points. All piers are founded upon rock. Foundation explorations were made at all pier locations to determine satisfactory depths of footings.

Three of the piers extend down be-

low river level, and will require concrete foundations poured under water. Construction joints are provided in the pier shafts at 20-foot intervals; a horizontal distribution girder, or "floor," being located at these points. Piers are battered $1\frac{1}{8}$ inch to 12 inches for appearance.

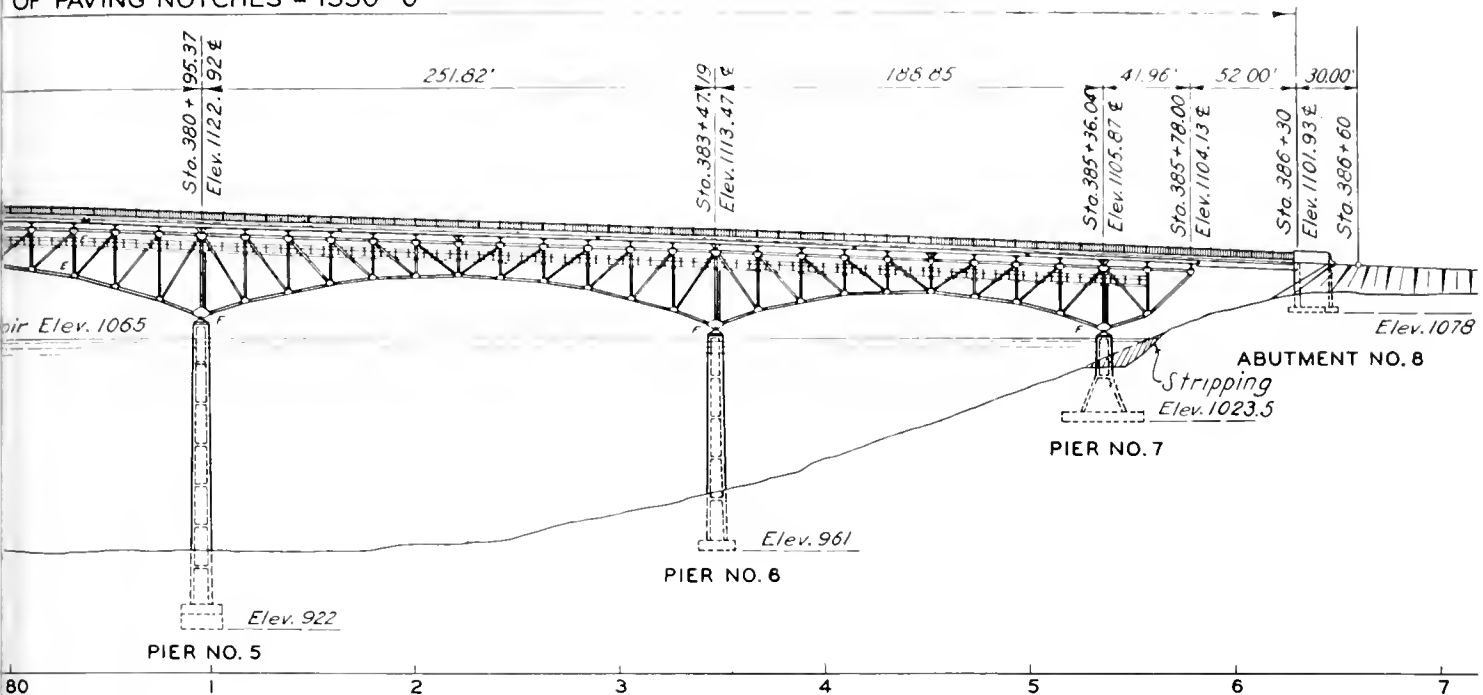
As the ultimate water level in the Shasta Reservoir will practically submerge the main piers, openings are provided at various points in the pier walls and floors to permit the free passage of water. This procedure not only eliminates hydrostatic pressure on the pier walls but adds considerable "mass" or "inertia due to weight of fluid" to resist earthquake forces, discussed later.

Next to structural safety, a fundamental requirement, smooth deck surfaces and good railing appearance are probably the two most important factors to the motorist. Considerable care was taken, therefore, to insure good results in the completed structure, as follows:

(1) A railing and gutter profile was established for each side of the

State Highway Relocation Across Shasta Reservoir

OF PAVING NOTCHES = 1330'-0"



Associate Bridge Engineer

bridge, using long 1400-foot vertical curves to give a smooth change of superelevation over the structure to fit approach alignment.

(2) Truss deflections due to full dead load were carefully computed, and elevations determined for each truss panel point to fit an "unloaded" profile. This "unloaded" profile is the final profile, plus the anticipated deflection under dead load.

(3) The fabricating shop will sub-punch, or sub-drill, all main truss connections, then completely assemble each truss in a horizontal position in the shop, placing each top chord panel point in its correct relative position to fit the "unloaded" profile.

(4) All truss joints are then reamed to full size, and all members match-marked for erection.

(5) Trusses may then be erected at the bridge site in any desired order as correct position is secured simply by jacking the trusses into shape until all truss connections are fair. No field drilling of these connections will be allowed.

(6) The concrete deck will then be

poured in any order to suit the contractor's working schedule. This is an important feature, as pouring a deck slab uniformly from one end of a structure to the other is much less costly than requiring short individual pours over various parts of the bridge, as has heretofore been necessary in trusses of this type.

DECK IS "CUT LOOSE"

To prevent participation of the concrete deck slab in resisting stress set up in the trusses by the weight of the slab, as it would surely do if rigidly attached, the deck has been literally "cut loose" by introducing small expansion joints in the stringers approximately 100 feet apart. This is of no consequence to actual strength of truss members, but has a pronounced effect upon deflection of the trusses. As accurate truss-deflections can be determined only if the slab is prevented from taking direct stress, this procedure is essential to secure a smooth deck.

It is most important in constructing a concrete deck to anticipate accu-

ately the deformation of the various members involved, as correcting a rough or wavy deck after construction is a difficult and costly process.

To eliminate deflection stresses from the piers, temporary expansion rollers will be used at the tops of all piers. Upon completion of the deck slab and upon a suitable day of average temperature, the truss shoes will be grouted into permanent position.

ROTATING TYPE JOINTS

Piers are arranged so that the four main piers on either side of the central span are supported longitudinally by anchor piers of comparatively low height located high up on the canyon walls. The main trusses are pin connected to the tops of all piers. A suspended span in the central 273-foot span, with provision for expansion at one end, establishes a symmetrical truss layout, continuous over three supports on each side of this span. Trusses are then fully "indeterminate" only over the center support of the group, the "degree of

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Santa Susana Mountain ridge in process of being cut through to transform Newhall Tunnel into an open cut highway.

Newhall Tunnel Replaced by Cut

By JOHN D. GALLAGHER, Assistant Highway Engineer

ACROSS the northerly end of the San Fernando Valley, some thirty miles north of the center of Los Angeles, extends the rugged, brush covered range of the Santa Susana Mountains which has long presented a troublesome barrier to road builders.

In the earlier days of development of this portion of the State, energetic pioneers hewed a narrow vertical cut through a low point in the hills. This cut, known as "Fremont Pass," served travelers to the north of Los Angeles until 1910, at which time Los Angeles County constructed a tunnel through the hills just southerly of the town of Newhall. This arch tunnel, only 17 feet-five inches wide, was used by the rapidly increasing traffic from the metropolitan Los Angeles area to the San Joaquin Valley, Mojave and

the Owens Valley for the next twenty years.

In 1928-29 the California Division of Highways constructed a three-lane highway through Weldon Canyon, west of the tunnel, for traffic to the San Joaquin and Sacramento valleys. Thus, the tunnel which had become a serious bottleneck was relieved of a large portion of traffic. During the past ten years, however, traffic to Antelope Valley, Owens Valley and the northwestern portions of the colorful Mojave Desert increased to an average of 4000 cars a day, with Sunday traffic during the wildflower season reaching 20,000 cars in nine hours. Under this congestion Newhall Tunnel again became an intolerable bottleneck.

On May 5, 1938, a contract was awarded by the State for reconstruc-

tion of this portion of the route as a unit in the program for a new alignment of the highway between the San Fernando Valley and Mojave along the so-called Mint Canyon Short Cut.

The contract included construction of 3.73 miles of State highway, between Foothill Boulevard and Placerita Canyon on the Mint Canyon Cut-off, where a connection was made with another unit of the general improvement. From the Foothill Boulevard junction, which is about a mile south of the old tunnel, to a point almost a mile north of the tunnel, the project followed the old road. The contract called for a divided highway, with two 12-foot center lanes of plant-mixed surfacing and two outside lanes of portland cement concrete, each 11 feet wide, with 7-foot shoulders. The central dividing strip is four feet



Modern 4-lane section of Newhall Tunnel highway has a raised central dividing strip covered with plant-mixed surfacing.



Narrow Newhall Tunnel bottleneck on State Highway 23 as it appeared before excavating of cut slopes as indicated by dotted lines.

wide with concrete curbs and covered with a plant-mixed surfacing.

At the point one mile north of the old tunnel location, the new highway leaves the road to Newhall and bears to the right on new alignment as part of the Mint Canyon Cut-off. This section was constructed with a three-lane plant-mixed surface 33 feet wide and 8-foot shoulders.

The major interest of the contract centered around the replacement of the tunnel with an open cut and this phase of the contract was graphically presented in the final report on the work submitted by Mr. S. V. Cortel-yon, district engineer, at Los Angeles.

The tunnel was 435 feet long, concrete lined, with a grade line 200 feet below the top of the hill and entirely within the prism of the proposed cut. Investigation had shown the hill to be composed of cemented conglomerate and sandstone, indicating that no serious difficulty would be encountered in excavation. As traffic was carried through the tunnel during construction, protection from falling material at the tunnel portals was provided by a thirty-foot timber extension of the tunnel on I-beam posts and caps. The extension above the tunnel portal also provided a suitable area for the operation of power shovels and trucks and was used first at the north portal, then moved to the south portal to serve the same purpose. Ramps were constructed from the existing road to the area above the tunnel.

The greater portion of the material in the cut was loosened with rooters and bulldozed from the top of the cut to the working area above the tunnel portal where it was loaded by two 2½-yard shovels into a fleet of sixteen 10-yard dump trucks. The cut was designed for one-half to one slopes.

DRILLING AND BLASTING OPERATIONS

No blasting was done in the removal of the upper 120 feet of the cut. When excavation had reached a point about 60 feet above the tunnel roof drilling and blasting operations were begun. Holes were drilled with a wagon drill rig to depths of 35 to 40 feet and the material loosened with charges of approximately 1000 pounds of black powder to each hole. In order to minimize loosening material in back of the designed slopes firing was limited to four holes at a time.

Operations advanced until excavation had been completed to an elevation about 10 feet above the tunnel

roof (about 30 feet above the roadbed grade) when a slide occurred on the easterly slope which entirely blocked the south portal of the tunnel. The slide moved along one of several slip planes which dipped toward the roadbed at angles of from 20 to 35 degrees.

Slope design on the easterly side was then changed to 1 to 1 and approximately 42,000 yards of material from the top 65 feet of the cut placed in adjacent canyons by the use of bulldozers and carryall scrapers. From this point the material remaining back to the 1 to 1 slope was brought into the cut by blasting and bulldozing where it was loaded into trucks with power shovels and hauled to widen fills.

RECURRENCE OF SLIDES

The 1 to 1 slopes did not, however, prove to be sufficiently stable and another slide came in on the easterly side near the north end of the cut. On this portion the slopes were flattened further to 1½ to 1. Just after this work was completed a triangular wedge of about 500 cubic yards slid out in back of the 1½ to 1 slope, indicating that eventually all the material above the slip plane might slide into the cut. Removal of all this material would have involved a greater yardage than funds provided for the work would permit.

At the same time other slides occurred at the southerly end of the cut and in high cuts immediately south of the tunnel cut. In all cases it was noted that the material had broken out in triangular sections, bounded on the southerly side by nearly vertical planes more or less parallel to the direction of dip and that movement of the sliding mass was along the direction of dip, which formed an oblique angle with the roadway gutter line. The slip planes intersected the gutter line at various points throughout a distance of about 800 feet.

To determine the limits of material required to be removed in order to stabilize the cut slopes, planes with a ¾ to 1 slope were passed through the intersections of the slip planes and the gutter line and on a line approximately 10 degrees back of the direction of slip. All material north of these slope planes, down to the surface of the slip plane was removed. By this method the material remaining south of the slope planes and below the slip planes was supported at the toe, and the total amount of ma-

terial removed was much less than if a uniform slope of sufficient flatness to stable had been adopted.

611,000 YARDS REMOVED

The result of this procedure in removing unstable material is a series of saw-toothed peaks or ridges with valleys intersecting the gutter line.

The westerly slope of the tunnel cut has remained stable on the ½ to 1 slope to which it was originally designed and constructed.

The preliminary estimate of roadway excavation for the area in which the heavy slides occurred was 295,000 cubic yards on the basis of the designed ½ to 1 slopes. The slide yardage removed amounted to 316,000 cubic yards making a total of 611,000 cubic yards of material removed in the construction of the tunnel cut.

On the remaining portions of the roadway little difficulty in excavation was encountered, although some of the cuts reached 100 feet in height and required considerable drilling and blasting to bring material down to the roadway where it could be loaded into trucks with power shovels.

The preliminary estimate of excavation quantities for the entire 3.7 miles of the project was 520,000 cubic yards and the final quantities showed that approximately 857,000 cubic yards were removed, an excess of 337,000 cubic yards, nearly all of which came from the tunnel cut.

PAVED DRAINAGE DITCH

Other features of the contract such as the plant-mixed surfacing, portland cement concrete pavement and shoulder treatment followed more or less standard practice. The construction of a paved drainage ditch along one portion of the project, followed, however, experimental lines. The ditch was built on a curved section and paved with asphalt concrete reinforced with wire mesh.

The length of the ditch was about 300 feet and has a top width of 39 feet with a flow line 6 feet below the top. The section is curved, with a radius of 35 feet. The grade of the ditch was finished by hand trimming using a circular templet and compaction of the subgrade accomplished with an eight-ton tandem roller. The asphalt concrete was spread and raked by hand and compacted by the tandem roller.

After one inch of the surfacing was in place the wire mesh reinforcement

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New Cut in Bay Bridge Toll Rates Goes into Effect

AN OUTSTANDING demonstration of the benefits that can be obtained for the people through public ownership was given on January 1, 1940, when in conformity with Governor Culbert L. Olson's determination to reduce tolls on the San Francisco-Oakland Bay Bridge as rapidly as revenues of the great span permit, another reduction was made in the automobile, truck, trailer and commutation rates.

The California Toll Bridge Authority by unanimous vote on December 12, 1939, authorized the decrease in rates.

Action of the Authority was in line with Governor Olson's policy of giving to the people under public ownership the greatest possible benefits accruing to them under such ownership, and constituted the second reduction in Bay Bridge tolls made under the present State administration.

"CONSPICUOUSLY SUCCESSFUL"

"Public ownership and State operation of the San Francisco-Oakland Bay Bridge are proving conspicuously successful," Governor Olson declared in announcing the new toll decrease. "That is why we are able to make further reductions at this time in charges for the use of the Bay Bridge. We shall put lower tolls in effect in the future just as soon as the income of the bridge warrants."

The Authority by its action cut the toll for pleasure automobiles from 40 cents to 35 cents per vehicle with no charge for extra passengers.

The superseded rate had been 40 cents for an automobile (including the driver and up to four passengers) but with extra passengers paying 5 cents each.

Rates for automobile commuters were reduced from \$14 to \$12.25 and from \$11.60 to \$10.25, respectively, which approximates 25 cents per one-way ticket.

For automobile trailers the toll was cut from 50 cents to 35 cents.

Provided the bus lines operating over the bridge apply to the Railroad

Commission for new tariff rates which will give to their passengers the benefit of the reduction in bus tolls, the rate for buses will be fixed at a flat toll of \$1 with no extra charge for passengers. Buses now pay 75 cents per vehicle and 5 cents for each passenger carried.

The Authority empowered its secretary, Director of Public Works Frank W. Clark, to put the new bus tolls into effect when the bus lines obtain approval of new tariff rates in which will be reflected the saving to their passengers.

An important new regulation affecting trucks was approved. Formerly trucks paid 50 cents per vehicle and 2 cents for each 100 pounds of load carried. The new toll is based on the gross weight of the truck and load and is intended principally to speed up the weighing of trucks at the toll station.

GRATIFYING TO AUTHORITY

In submitting the matter of further toll reductions at the recent meeting of the Authority, Governor Olson said:

"When the tolls were reduced from 50 cents to 40 cents, we announced that as soon as conditions would allow, in keeping with the underwriting contract for the bond issue, there would be a further reduction. I understand from the Director of Public Works and counsel for the Authority that conditions have now obtained under which there can and may be further reductions. Therefore, I would like to take that matter up at this time.

"It is gratifying to the Authority to make these reductions which are largely beneficial to the motoring public. The motorist, commuter and patrons of bus lines will all benefit materially under the new tolls. In the case of the bus operators, they will have to submit new tariff rates to the Railroad Commission and if these rates give to bus passengers the full benefit of the elimination of toll charges for each passenger, then

Director of Public Works Clark is authorized to put the revised tolls into effect.

THOUSANDS WILL BENEFIT

"Thousands of Californians in the interior of the State who use bus lines in traveling to San Francisco will be the beneficiaries."

The new method of weighing trucks on a gross weight and load basis will facilitate truck transportation across the bridge by saving a great deal of time at the toll stations.

Following are the new and old rates on the bay bridge:

CLASS	VEHICLES	NEW RATE	OLD RATE
1	Automobiles, ambulances, taxis, commercial or light delivery automobiles	\$0 35	\$0 40
2	Trailers drawn by automobiles	.35	.50
3	Trucks or truck trailers, including any load:		
	Gross weight up to 20,000 lbs., per ton, at	175	60
	Additional gross weight from 20,000 lbs. to 40,000 lbs., per ton, at	15	for truck
	Additional gross weight over 40,000 lbs., per ton, at	.125	.40 per ton for net load
	Minimum charge	.50	
4	Local Key System buses, per passenger carried	.025	No change
*5	Other buses	1 00	Bus 75 Passengers 05
6	Motorcycles	15	20
7	Tricars	.25	30
8	Vehicles requiring special permit, per ton		
	Gross weight	20	.40
	Minimum charge	1 00	1.00
9	Vehicles not otherwise specified, per ton		
	Gross weight	.175	.40
	Minimum charge	50	60
	The following monthly commutation rates are prescribed:		
10	Commutation—For passenger automobiles only. Book to contain from 50 to 54 one-way trip tickets depending on length of calendar month good for the calendar month.	\$12 25	\$14.00
	In addition the book will contain twenty 20 provisional tickets, each good for a one-way trip upon presentation and payment of twenty-five cents (.25c) providing all regular tickets have been used. Additional provisional tickets for the same calendar month will be issued upon surrender of the complete empty cover—front and back—of a \$12.25 commutation book of the same month.		
11	Commutation—For passenger automobiles only. Book to contain 40 one-way trip tickets, good for the calendar month.	\$10.25	\$11.60
	In addition, the book will contain ten 10 provisional tickets, each good for a one-way trip upon presentation and payment of twenty-five cents (.25c) providing all regular tickets have been used. Provisional tickets, in excess of the above will not be issued to purchasers of this book.		

*Subject to future action of California Railroad Commission.



Scene showing bags being filled at concrete mixing machine and carried by crews for placement on Cache Creek embankment.

Concrete Riprap Bank Protection

By C. F. CHILD, District Construction Engineer

SOME of the highest water in the memory of the oldest citizens was experienced in the Sacramento Valley in December, 1937, and considerable damage was done to many sections of roads, most of which have been repaired or restored.

Shortly after the storm our central office caused a complete state-wide survey to be made of the adequacy of different types of slope protection and of the suitability for different conditions. Guided by the report of this survey sacked concrete riprap was selected as slope protection for the sections of Route 50 between Rumsey in Yolo County and the junction of Route 15 en route to Clear

Lake in Lake County via Cache Creek and Bear Creek.

Sections of the road along these creeks had been entirely washed away, showing a tremendous action of the water in carrying away portions of the road containing boulders of from five to eight feet in diameter and leaving a hillside where once was a road.

PLACED IN THREE LOCATIONS

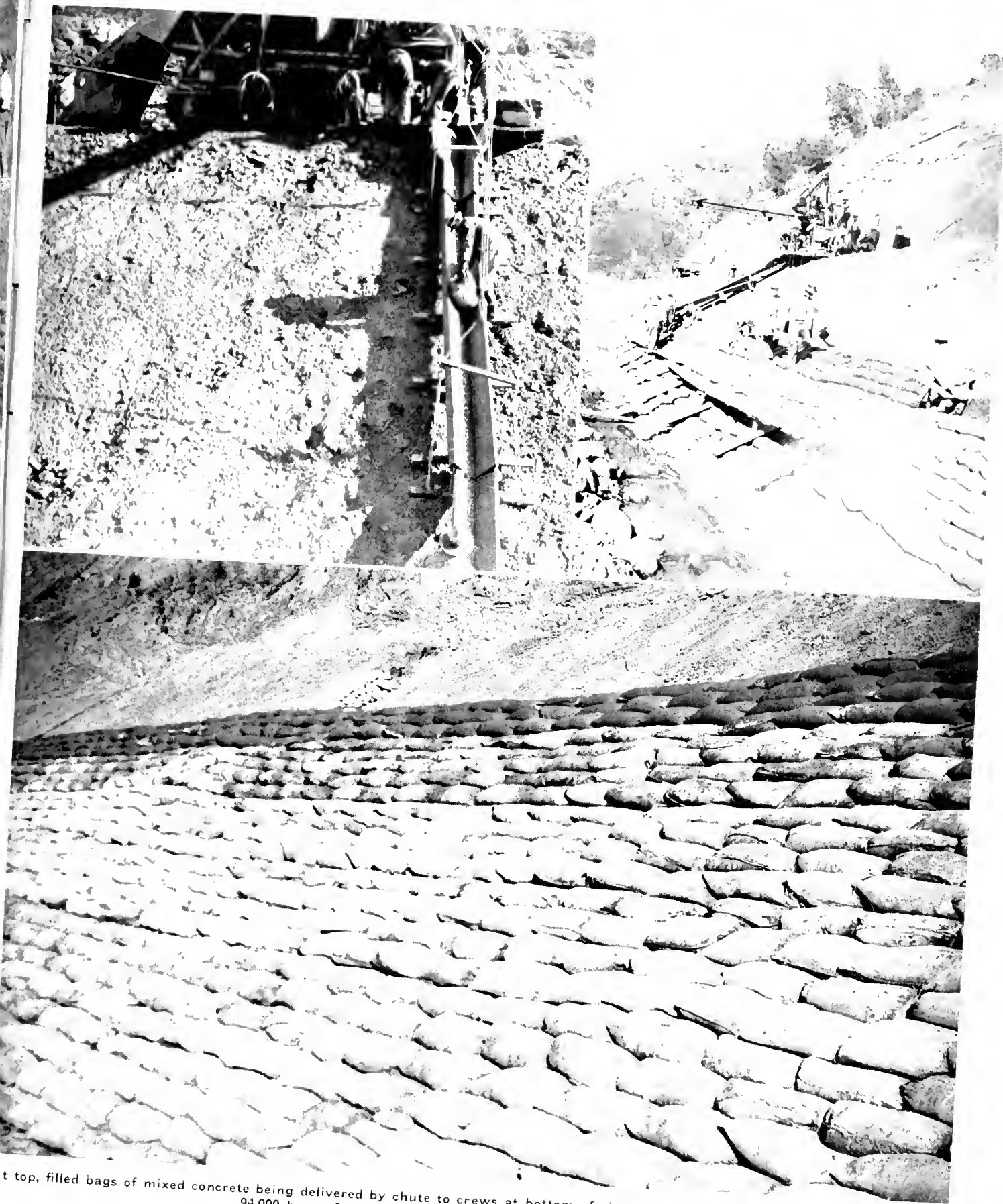
Sections of rock riprap had been placed protecting the slopes. Some sections were overtopped and partially carried off by the current, resulting in the loss of considerable roadway. The road was partially restored for

one-way traffic by the maintenance forces until such time as funds were available for more permanent construction.

In September, 1939, a contract was let involving approximately 94,000 sacks of concrete riprap along with 2100 cubic yards of rock riprap and other items of construction, being the largest amount of sacked concrete placed in District III, totaling 2645 lineal feet in three locations. The average height was approximately 22 feet.

A suitable foundation of bedrock or large boulders was found from four

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At top, filled bags of mixed concrete being delivered by chute to crews at bottom of riprap job. Below—Close-up of a portion of the 94,000 bags of concrete riprap required on the Cache Creek job.

University Avenue Grade Separation in Berkeley Formally Dedicated

MADE the occasion for a gala city-wide celebration, dedication of the newly completed University Avenue grade separation at Berkeley attracted a large crowd of citizens on Saturday, January 6, at which State, county, city and Federal officials made brief addresses.

In the absence of Governor Culbert L. Olson, who was in Los Angeles on State business, Larry Barrett, chairman of the California Highway Commission, dedicated the \$330,000 project to public service, following a program of music and speech-making.

Many years before the building of the San Francisco-Oakland Bay Bridge and the East Shore Highway, the need for a grade separation at the intersection of University Avenue and the main line tracks of the Southern Pacific was recognized. Back in the early twenties, when ferries first began to carry motor traffic between the Berkeley pier and San Francisco, relief for traffic delays at this crossing became apparent. With the great impetus given to traffic by construction of the Bay Bridge and the East Shore Highway, this need became a pressing necessity.

City Manager Hollis Thompson, and other Berkeley officials, implored the California Highway Commission to include the construction of a grade separation at this site in the Division of Highways' Federal financed program for elimination of grade crossing hazards on feeder roads off the State highway system. The data submitted by the Berkeley authorities reflected the thoroughness of their preliminary studies and convinced State highway officials of the necessity of the improvement.

As University Avenue is not located on the State highway system, the only method by which construction of the structure could be financed by the State was by including it in a Federal grade crossing elimination program. Funds for these programs are apportioned by the Public Roads Administration of the United States Government from

appropriations made by Congress for Federal Aid to States for highway work. State highway departments are permitted to use a portion of these grade crossing funds for projects located on feeder roads which are off the State highway system.

It was as this type of project that the University Avenue grade separation was included by the California Highway Commission in the program financed from funds provided by the Federal Government for the two-year period between July 1, 1937, and June 30, 1939.

Comparative preliminary engineering studies and estimates by State highway bridge engineers determined an overhead structure as more suitable and economical to the site than an underpass type. On the basis of these studies, the final design for the modern structure which was turned over to the City of Berkeley was completed.

4-LANE DIVIDED ROADWAY

The overhead itself is of most modern design. The fifteen reinforced concrete slab spans and three steel girder spans total 922 feet. The central steel girder span over the railroad tracks is 118 feet, 6 inches in length, and the two adjoining steel girders are each 85 feet, 6 inches. These three steel spans are carried on reinforced concrete piers which rest on pile foundations. The fifteen concrete slab spans vary in length from 33 feet to 48 feet and are supported by concrete bents.

The roadway across the structure is designed for safety. Four traffic lanes, each 12½ feet wide, are divided by a four-foot curbed median strip and provide ample facilities for both east- and west-bound traffic.

The cost of the overhead, its approaches, and the street work alongside and beneath the structure will amount to approximately \$330,000. These funds were provided entirely from Federal apportionments to California for grade crossing elimination.

The only major direct cost to the

City of Berkeley has been provision of additional right of way on each side of University Avenue. This was necessary to provide adequate width for satisfactory street construction for local traffic not using the overhead.

FUTURE GRADE SEPARATION

While this overhead is now complete, grade lines at the intersection of University Avenue and the East Shore Highway have been laid so as to conform with plans for an intended grade separation to be built in the future at that junction.

In the meantime, funds have been provided for the installation of semi-traffic-actuated signal lights at the East Shore intersection. This signal system is so designed that cars on University Avenue, approaching the East Shore Highway and wishing to make a left turn or cross the thoroughfare, will automatically turn traffic lights to "stop" against the East Shore Highway traffic for a sufficient time interval to permit the car to safely enter the traffic stream on the highway.

The "robot" controlling these lights is so constructed that a maximum time limit is established for stopping traffic on the highway and, should a more or less continuous line of cars on University Avenue approach the East Shore Highway, the signal system will operate alternately with conventional red and green lights to control the traffic in both directions as at any other intersection.

While the basic engineering features entering the design of the present overhead follow conventional principals and practice, the treatment of the structural members has been such as to give a modernistic, streamlined appearance.

TRIBUTE TO DEMOCRACY

In his dedicatory address, Chairman Barrett said in part:

"We may well be thankful to live in a land of true democracy where a structure such as this stands as a

(Continued on page 28)



At top, University Avenue overhead structure in Berkeley dedicated January 6. Center, left, Group, C. H. Sweetser, Public Roads Administration, Mayor Frank Gaines, "Miss West Berkeley" (Rene Verbeck), Chairman Larry Barrett, State Highway Commission, District Engineer Jno. H. Skeggs. At right, view of four-lane divided roadway. At bottom, crossing of main railroad tracks.

Highway Bids and Awards for the Month of December, 1939

INYO COUNTY—Between Big Pine Airport and Big Pine, about 1.6 miles to be graded and surfaced with road-mix surfacing. District IX, Route 23, Section C. Ishell Construction Co., Reno, Nev., \$27,659; Valley Construction Co., San Jose, \$28,459; A. S. Vinnell Co., Alhambra, \$29,552; Anderson & France, Visalia, \$30,858; G. W. Ellis, No. Hollywood, \$30,918; Oilfields Trucking Co., Bakersfield, \$32,085; Triangle Rock & Gravel Co., San Bernardino, \$33,652. Contract awarded to Basich Bros., Torrance, \$25,492.

LASSEN COUNTY—Between Milford and Bird Flat, about 10.5 miles to be graded and penetration oil treatment and seal coat applied. District II, Route 29, Section D. Fredrickson Bros., Emeryville, \$69,890; Ishell Construction Co., Reno, Nevada, \$71,949; Claude C. Wood, Lodi, \$73,249; Poulos & McEwen, Sacramento, \$74,148; Fredrickson & Westbrook, Sacramento, \$77,330; Harms Bros., Sacramento, \$77,805; Louis Biasotti & Son, Stockton, \$79,360; Lee J. Immel, Berkeley, \$79,486; Heafey-Moore Co. and Fredrickson & Watson Construction Co., Oakland, \$79,907; Dodge Construction, Inc., Fallon, Nevada, \$80,839; M. J. B. Construction Co., Stockton, \$81,287; Utah Construction Co., San Francisco, \$81,802; McNutt Bros., Eugene, Oregon, \$87,422; A. Teichert & Son, Inc., Sacramento, \$88,818; Hemstreet & Bell, Marysville, \$95,874. Contract awarded to Parish Bros., Hollywood, \$66,383.90.

LOS ANGELES COUNTY—A reinforced concrete slab bridge across each branch of Compton Creek to be constructed, and approaches graded and surfaced with plant-mixed surfacing. District VII, Route 175, Section A. Oscar Oberg, Los Angeles, \$5,554; R. M. Price, Huntington Park, \$6,085; Carl Hallin, Los Angeles, \$6,216; W. E. Robertson, Los Angeles, \$6,286; Fred Fredenburg, San Francisco, \$6,399; W. J. Disteli, Los Angeles, \$6,612; A. S. Vinnell Co., Alhambra, \$6,624; T. P. Schultz, Compton, \$7,327; C. R. Butterfield & Kennedy Co., San Pedro, \$7,990; Sordal & Bishop, Long Beach, \$8,638. Contract awarded to Mojave Corp., Los Nietos, \$5,553.50.

LOS ANGELES COUNTY—Between Main Street and Central Avenue, about 1.5 miles to be graded and paved with Portland cement concrete and asphalt concrete. District VII, Route 175, Section A. J. E. Haddock, Ltd., Pasadena, \$103,796; Basich Bros., Torrance, \$106,725; Radich & Brown, Burbank, \$110,203; Griffith Co., Los Angeles, \$111,240; Sander Pearson, Santa Monica, \$114,496; Spicer & Thompson, Los Angeles, \$111,742; Claude-Fisher Co., Ltd., Los Angeles, \$114,263; Matich Bros., Elsinore, \$116,863; Dimmitt & Taylor, Los Angeles, \$119,282; R. M. Price, Huntington Park, \$122,406; Sully-Miller Contracting Co., Long Beach, \$125,526. Contract awarded to Oswald Bros., Los Angeles, \$97,097.40.

NEVADA COUNTY—Between 1½ miles south and 1½ miles north of Rattlesnake Creek, about 3 miles to be graded and surfaced with plant mixed surfacing on crusher run base. District III, Route 17, Sections A, B. Claude C. Wood and Frank B. Marks & Sons, Lodi, \$111,861; Parish Bros., Hollywood, \$112,098; Fredrickson Bros., Emeryville, \$113,393; Harold Smith, St. Helena, \$114,592; Harms Bros. & N. M. Ball Sons, Berkeley, \$114,641; The Utah Construction Co., San Francisco, \$118,911; J. R. Reeves, Sacramento, \$120,780; Piazza & Huntley, San Jose, \$126,384; A. Teichert & Son, Inc., Sacramento, \$127,578; Louis Biasotti &

Son, Stockton, \$130,919; Ishell Construction Co., Reno, Nevada, \$150,338; McNutt Bros., Eugene, Oregon, \$151,180. Contract awarded to Hemstreet & Bell, Marysville, \$105,727.90.

RIVERSIDE COUNTY—At Salton Creek, about 33 miles south of Indio, a reinforced concrete bridge to be constructed and approaches, about 0.64 mile in length, to be graded and road-mix surface treatment applied. District XI, Route 187, Section A. G. W. Ellis, North Hollywood, \$39,682; B. G. Carroll, San Diego, \$40,877; Martin & Schmidt Contractors, Long Beach, \$41,186; A. S. Vinnell Co., Alhambra, \$41,506; R. M. Price, Huntington Park, \$41,866; J. E. Haddock, Ltd., Pasadena, \$43,155; J. S. Metzger & Son, Los Angeles, \$43,333; T. P. Schultz, Compton, \$46,620; V. R. Dennis Construction Co., San Diego, \$48,750; Gibbons & Reed Co., Burbank, \$50,936; Contracting Engineers Co., Los Angeles, \$61,767. Contract awarded to Valley Construction Co., San Jose, \$38,181.

SACRAMENTO AND EL DORADO COUNTIES—Between 3¼ miles east of Folsom and 2½ miles east of Clarksburg, about 5.8 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District III, Route 11, Sections A, A. Parish Bros., Hollywood, \$248,062; Utah Construction Co., San Francisco, \$249,991; Maceo Construction Co., Clearwater, \$255,227; Eaton & Smith, San Francisco, \$262,962; Daley Corp., San Diego, \$262,518; Harms Bros. & N. M. Ball Sons, Berkeley, \$276,170; Jones & King, Hayward, \$277,496; Louis Biasotti & Son and Piazza & Huntley, San Jose, \$288,233; Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, \$288,264; Granfield, Farrar & Carlin, San Francisco, \$298,307; A. Teichert & Son, Inc., Sacramento, \$368,312. Contract awarded to Hemstreet & Bell, Marysville, \$230,837.75.

SAN DIEGO COUNTY—A reinforced concrete box girder bridge on Washington Street at Sixth Avenue in the City of San Diego to be constructed. District XI, Washington St. Extension. Daley Corp., San Diego, \$133,814; Chas. J. Dorfman, Los Angeles, \$136,377; B. G. Carroll & H. L. Foster, San Diego, \$142,740; Byerts & Dunn, Los Angeles, \$143,330; J. S. Metzger & Son, Los Angeles, \$149,142; B. O. Larsen, San Diego, \$152,864; Carlo Bongiovanni, Los Angeles, \$153,456; J. E. Haddock, Ltd., Pasadena, \$156,264; Sordal & Bishop, Long Beach, \$166,381. Contract awarded to Contracting Engineers Co., Los Angeles, \$132,422.50.

SANTA BARBARA COUNTY—Between one-half mile east of El Capitan Creek and Orella, about 2.3 miles to be graded and surfaced with plant-mixed surfacing. District V, Route 2, Sections G, F. J. E. Haddock, Ltd., Pasadena, \$181,085; A. Teichert & Son, Inc., \$187,136; Denni Investment Corp., Wilmington, \$190,135; Basich Bros., Torrance, \$194,832; Daley Corp., San Diego, \$197,686; Hemstreet & Bell, Marysville, \$204,327; N. M. Ball Sons, Berkeley, \$207,479; Claude-Fisher Co., Ltd., Los Angeles, \$210,244; United Concrete Pipe Corp., Los Angeles, \$214,059; Radich & Brown, Burbank, \$216,091. Contract awarded to R. E. Hazard & Sons and Clarence Crow, San Diego, \$178,076.90.

SANTA CLARA COUNTY—Between Oaks Road and Los Gatos about 1.8 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District IV, Route 5, Sections C, B. Los Gatos. Gran-

field, Farrar & Carlin, San Francisco, \$170,467; Maceo Construction Co., Clearwater, \$186,777; Piombo Bros. & Co., San Francisco, \$219,598. Contract awarded to Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, \$160,969.10.

SHASTA COUNTY—A steel deck truss bridge with concrete deck on concrete piers and abutments to be constructed across Sacramento River about 30 miles north of Redding. District II, Route 3, Section C. Barret & Hilp, San Francisco, \$676,920; Heafey-Moore Co.-Fredrickson & Watson Construction Co., Oakland, \$677,109; Engineers, Limited, San Francisco, \$680,650; A. Soda & Son, Oakland, \$690,932; Bates & Rogers Construction Corp., Oakland, \$703,178; C. W. Caletti & Co., San Rafael, \$757,180. Contract awarded to United Concrete Pipe Corp., Los Angeles, \$673,046.

Newhall Tunnel Replaced by Cut

(Continued from page 18)

was laid and the remaining pavement material placed and rolled. The finished thickness of the pavement was three inches. Aggregate for the surfacing provided 100 per cent passing a 1 inch screen, 65 per cent passing a No. 3 sieve and 4 per cent passing the 200 mesh. Six per cent of Grade "D" asphalt was the binder.

DITCH CONSTRUCTION EXPERIMENTAL

While the California Division of Highways has constructed many miles of various types of paved drainage ditches, the use of wire mesh reinforcement with asphalt concrete is an experiment and the service which this ditch renders during the storms of the next few winters will be watched with interest.

Supervision of the design and construction of the project was under S. V. Cortelyou, District Engineer and E. L. Seitz was Resident Engineer in direct charge of the work. The contractor was Griffith Company of Los Angeles. The entire project cost \$475,700 of which approximately \$191,000 was for roadway excavation.

The highway is an example of that large class of highways which are not main inter-city arterials but which are called upon to carry relatively large volumes of traffic with high peaks of density. The construction standards are typical of present California practice on these important thoroughfares.

Highway Relocation Across Shasta Reservoir

(Continued from page 15)

indeterminancy" diminishing toward the two outer supports of the group, becoming fully "determinate" at these supports and beyond.

In order to support the main piers in a longitudinal direction, the trusses are attached to the pier tops by a rotating type of joint that will transmit horizontal shear, but no bending moment. The elimination of a moment connection is important as a rigid type of connection would practically double the temperature stresses in trusses and piers set up by horizontal deflection of the piers.

Transversely, the four high piers must provide their own stability. No temperature stresses exist in this direction, but wind and earthquake forces are quite severe. Analysis of the effect of "wave action" of the reservoir water due to earthquake forces was made. This "wave action" effect refers to the oscillating motion set up by an earthquake, and should not be confused with surface "waves" due to wind or tide. Extensive research and model experimentation has been done in this field by the U. S. Reclamation Bureau at Denver, Colorado. The Department is indebted to the Reclamation Bureau for the use of these studies.

TRUSSES BEND AROUND CURVE

Trusses are bent horizontally at two points between each pier rather than at the piers, to fit the horizontal curve of the bridge. A number of advantages result from this:

1. The eccentricity, or overhang, of deck stringers relative to the trusses is but one-fourth that produced by bending the trusses only at the piers. This eliminated additional steel in the floor-beams located between bend lines.
2. Bending moment in the truss is very low at the bend line due to the continuous truss layout. These bend lines occur at approximately the quarter points in the span where the dead load moments are practically zero.

Truss joint stresses are corre-

Bay Bridge Traffic Passes 30 Million Mark Since Opening November 1936

TRAFFIC on the San Francisco-Oakland Bay Bridge since its opening November 12, 1936, passed the thirty million mark by 24,621 on the last day of December, 1939. The total vehicles for the year 1939 reached a new high record of 10,963,432.

For the month of December the total traffic was 854,413 vehicles, compared with 822,494 for the preceding month and 783,846 for December a year ago. This was a very gratifying

increase although it would undoubtedly have been better had the harbor not been closed during the entire month. The increase in traffic over December a year ago was 8.3 per cent. Revenues, however, were 13.8 per cent less than a year ago. This is accounted for by the toll reduction that was made last July.

Christmas week was especially heavy in traffic and Christmas day alone accounted for 43,929 vehicles.

December totals and comparative figures were:

	Dec. 1939	Dec. 1938	Nov. 1939	Total 1939	Since Opening
Passenger autos and auto trailers	776,926	709,906	743,127	9,964,917	27,672,589
Motorcycles and tricycles	2,824	2,879	3,184	42,803	129,702
Buses	16,596	13,616	16,329	125,903	373,537
Trucks and truck-trailers	42,826	41,871	44,220	559,160	1,319,059
Others	15,241	15,574	15,634	271,042	529,734
Total vehicles	854,413	783,846	822,494	10,963,432	30,024,621
Extra passengers	265,599	247,439	267,327	2,506,884	8,256,519
Freight, tons	49,748	57,500	53,386	715,455	1,626,585

spondingly low, and the torque resulting from these stresses is greatly reduced. While it is true that the torsional stresses set up at the bend lines must be transferred along the trusses to the piers, stresses are so low as to require no additional metal in the main trusses to resist them. The writer knows of no previous use of this arrangement in American or European bridge construction.

NEW ALLOY USED

A newly developed alloy steel will be used in the trusses, with 50 per cent greater tensile strength and five times as rust resisting as ordinary structural steel. Its excellent corrosive resistance permitted minimum sections of $\frac{1}{4}$ " thickness, while the additional strength available resulted in large savings in weight of metal.

The truss member design represents a considerable departure from previous construction. All members consist of a 14-inch beam section, supplemented when necessary on the compression members with 15-inch or 18-inch channel sections shop welded to the beam flanges. No stay plates or lacing bars, formerly considered

indispensable to truss members, are used. This not only reduces shop fabrication, but eliminates excess metal not directly participating in stress resistance.

As truss members are perfectly smooth and accessible for painting, maintenance costs will be materially reduced.

ECONOMICAL "T" SECTIONS

Bracing members are made from structural tee sections obtained by splitting wide flange beam sections at the rolling mill when hot. These sections became available fairly recently and have proven very economical, reducing weight and eliminating shop fabrication.

Truss-shoes are built-up assemblies of rolled steel plate, shop-welded together to form a rigid unit. Welded frames constructed in this manner are far superior to steel castings in every respect. Alloy steel is used, resulting in a strength and ductility equal to that secured in the main truss. The largest truss shoe is approximately 5 feet square, 21½ feet high, and supports a load of more than 2,000,000 pounds.

Temperature variations of 20 to 120 degrees Fahrenheit produce a

(Continued on page 28)

Old Indian Trail Over Mountain Springs Grade Being Modernized

By E. E. SORENSON, District Construction Engineer

THE old Mountain Springs Grade connecting San Diego and Imperial counties, which supplanted ancient Indian trails, is in turn to be replaced by a standard highway over the In-ko-pah Mountain Range.

The first unit of construction in what is planned to be a complete modernization and realignment of the Mountain Springs Road, which is Route 12 from Boulder Park to Coyote Wells, has been completed and accepted by Director of Public Works Frank W. Clark.

The contract recently finished involved the complete realignment of 2.55 miles of extremely difficult mountain construction up the face of the In-ko-pah Range, which lies in the edge of the San Andreas Fault. The maximum grade was reduced in excess of 1.1 per cent; 950 degrees of curvature was eliminated, and the minimum radius decreased from 126 feet to 600 feet.

The average passenger car, which negotiated the old grade at 20 miles per hour, can now travel the new route at the legal speed limit.

SIGHT DISTANCE IMPROVED

Sight distance, which hampered travel on the old route, has been increased to eliminate all interference. Major construction items involved in the work included approximately 270,000 yards of rock excavation, which required 150 tons of dynamite, 11 million gallons of water, 900,000 station yards of overhaul, 18,000 yards of imported borrow, and 500 tons of liquid asphalt.

Records extending for many years into the past, indicate that the Mountain Springs route between the Imperial Valley and the coast has proved a difficult, but, nevertheless, the only feasible one for the primitive Indians, as well as the motorists of today.

The Yuma tribes from the Colorado Valley traveled this way to their fishing grounds on the coast. The In-ko-pah Indians, from which the

mountain range derives its local name, while not extremely war-like, nevertheless made numerous changes in the route of travel necessary.

The easiest and best trails followed Carriso Creek through Carriso Gorge to what is now known as Jacumba Hot Springs. That this range of mountains was for many years a serious obstacle is borne out by the histories of the various expeditions which avoided it.

In 1774 De Anza, after skirting the Sand Hills of Imperial Valley, marched through lower Carriso Valley, then continued on to the northwest, in preference to forcing his way over the mountains to the cooler coast route.

In 1846 and 1847 the expedition from Fort Leavenworth to San Diego, commanded by Lt. W. H. Emory, U. S. Topographical Engineer, was forced to avoid these same mountains and detour from Carriso via Warners Valley to San Diego.

The historical battle of San Pascual might have been avoided if, in 1846, General Stephen W. Kearney had found the Mountain Springs route less formidable and had not marched via San Felipe, Warners and Santa Ysabel to his defeat.

In 1857 the Butterfield Stage Company was awarded a contract to carry transcontinental mail. It found its objective by way of San Diego to be difficult, although affording a much cooler and more desirable route, and therefore blazed the now historic Butterfield Trail, which passes through Carriso and then avoids the mountains by heading northwest.

Beginning about 1890, the attractions of the Laguna Mountain, Jacumba Springs, and Boulevard Valleys to the settlers moving into the lower California Valley, made necessary the development of routes via Mountain Springs. These routes changed in location rapidly, from trails up Carriso Gorge to a stage route through Devil's Canyon, and then to one more nearly conforming

to the present road. These roads were built on excessive grades, with no surfacing, and subject to damage by sudden mountain storms.

Highway consciousness was first noted in San Diego County about 1908, when the construction of 450 miles of highway was started, using the proceeds of a bond issue. Records indicate that, about this same time, interest was awakened in the construction of a highway from Mountain Springs to Coyote Wells, through what was then commonly known as San Diego Canyon. The move was fostered by F. W. Jackson, who personally raised \$50,000 by popular subscription.

The road at this time climbed through an elevation of 2330 feet, had grades in excess of 22 per cent, and included nine miles of sand. With the \$50,000 the road was shortened to approximately 12 miles, the maximum grade reduced to 7 per cent, and all but one mile of sand eliminated. The need for this road was strongly felt by San Diego business men, who were determined to obtain a share of the valley business, which in 1912 amounted to \$10,000,000, and was being diverted mostly to northern cities.

The advent of the motor car and truck and its phenomenal increase in numbers and use made several changes necessary between 1912 and the current time, and the present highway is the result of several projects covering grading, paving and drainage, each one a decided improvement over that replaced.

Considerable credit is due to the A. S. Vinnell Company, contractors on the Mountain Springs grade job, for their efficient handling of modern highway equipment, which resulted in the successful completion of the job.

Work was done under the supervision of E. E. Wallace, District Engineer, who was represented in the field by R. C. Payne, Resident Engineer, and F. D. Pearce, Assistant.



New realigned Mountain Springs Grade highway ascending the rocky slopes of the In-ko-pah Mountain Range in San Diego County.

Concrete Riprap Bank Protection

(Continued from page 20)

to six feet below the stream bed, and after preparation of the embankment slopes to $1\frac{1}{2}$:1 and $1\frac{1}{4}$:1, a single layer of sacked riprap was placed thereon. Cut-off walls at 50-foot intervals were placed in these embankment slopes to confine the damage to small sections in case of failure.

Damaged portions of existing rock riprap approximately two feet thick were replaced in kind to well above the extreme high water mark and portions were grouted with concrete.

No doubt the behavior of the two types of riprap will be followed by some engineers with interest, as the velocities are high in both streams at times, and the work will be forced to withstand a severe test in the future.

There still remains considerable work to be done on this route and constant maintenance is necessary because of the steep hill slopes and poor stability of soils.

The road is subject to large slides coming into the roadway after each rain in the form of earth and water at about the consistency of a heavy syrup, making it difficult to keep culverts open, and the road clear.

The 1939 season was exceptionally dry and the run-off of the streams very light. The Contractor experienced very little difficulty from water in the construction of footings.

Work was completed December, 1939. J. W. Corvin was Resident Engineer.

Grade Separation Open

(Continued from page 22)

monument to the cooperative initiative of governmental groups and private industry.

"Here is a beautiful, modern highway structure, built, not at the command of some dictator, but built because you of Berkeley needed and desired it. You convinced the State of your need, and the State requested approval of the enterprise by the Public Roads Administration for construction to be financed with Federal funds appropriated by Con-

In Memoriam Everett N. Bryan

Everett N. Bryan, died at his home in College Tract, Sacramento, December 17, 1939, at the age of 55. Surviving are his widow, Mrs. Gladys Huber Trumbo Bryan; a son, Everett Elgin Bryan, both of Sacramento; a sister, Myrtle, and five brothers, Ross, Claude, Ellis, Jasper and Homer Bryan. He was a native of Montezuma, Iowa, educated in the public schools of California, graduating from the University of California with the class of 1907, of which he was secretary.

For two years after his graduation he was employed by the Western Pacific Railroad Company. From 1909 to 1921 he was actively engaged with irrigation construction and operation and for four years was chief engineer of the Waterford Irrigation District. In 1921 he took a position with the State Division of Water Rights. The Water Commission Act had been enacted some years before, but due to the shortage of engineers during the World War period the work of the Division had not become standardized.

Mr. Bryan immediately took a leading part in perfecting the procedure now in effect supervising the initiation and perfection of water rights. He became one of the best known engineering authorities in California on water rights and was eminent in this particular line.

At the time of his death he was supervising hydraulic engineer of the Division of Water Resources.

Mr. Bryan was a member of the American Society of Civil Engineers, was active in the formation of Sacramento section of the society, served on many of its committees, took an active interest in its affairs and was fifth president of the local section. He took a keen interest in all civic affairs. In 1928 he was a member of the Sacramento Water Commission for the investigation of a water supply for Sacramento.

When the law for registration of civil engineers was first proposed, Mr. Bryan took a leading part in drafting the proposed act and received Certificate of Registration No. 4 under the act, the members of the first Board of Registration having been assigned the first three numbers. As engineering was his profession, so was it his avocation. He was always keenly interested in every thing affecting his work and wrote many papers for leading engineering periodicals on various phases of engineering.

Mr. Bryan was a member of Sacramento Lodge No. 40, F. & A. M., and the Sutter Club. He had a gift of personal charm and affability, was a faithful public servant and loyal friend.

gress for that purpose.

"That is the public cooperation of a democracy.

"The overhead was designed by consultation among State highway engineers, your own city engineering staff and engineering officials of the Southern Pacific Railroad, and built under a State contract by Heafey-Moore Co. and Fredrickson and Watson Construction Co., who are private contractors.

"That is cooperation of public bodies and private industry.

"In all this procedure, mutual agreement was the basis of all negotiations.

"That is democratic initiative.

"And here stands a utilitarian public facility as a thing of beauty in satin-smooth concrete and sturdy steel for the free use of the citizens of Berkeley and the guests within their gates."

Highway Relocation Across Shasta Reservoir

(Continued from page 25)

total movement of nine inches at the one expansion joint in the truss system. A sliding "finger" type of joint is used in the deck slab, featured by a locking device that anchors it rigidly to the deck to prevent noise and vibration due to passing vehicles. The joint is self-cleaning, in that rubbish and dirt can not collect in the openings, but are pushed off by movement of the bridge.

An inspection walkway is provided under the roadway slab, with ladders leading down to each pier. Interiors of the piers are accessible for inspection.

Telephone and telegraph cables are carried across the bridge under the roadway deck.

The structure should be completed in July, 1941. Mr. Charles R. Poppe is Resident Engineer for the State on this project. The structure was designed by the Bridge Department under the direction of E. W. Panhorst, Bridge Engineer, L. C. Hollister, Design Engineer, and the writer.

The United Concrete Pipe Corporation of Los Angeles is the contractor having been awarded the contract by Director of Public Works Frank W. Clark on their bid of \$672,046, the lowest of seven bids received.

State of California

CULBERT L. OLSON, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

FRANK W. CLARK, Director of Public Works

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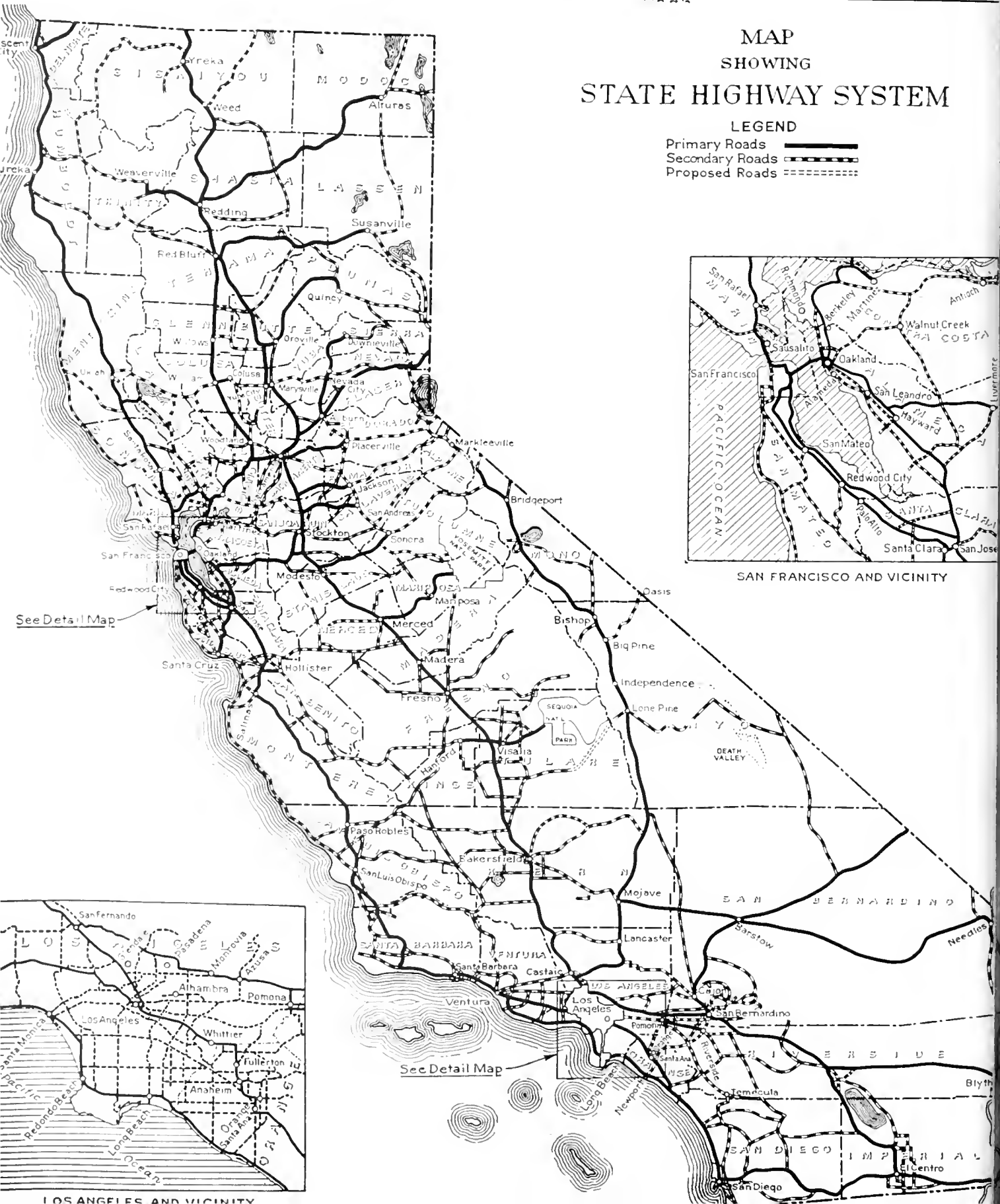
C. R. MONTGOMERY, Attorney

ROBERT E. REED, Attorney

MAP SHOWING STATE HIGHWAY SYSTEM

LEGEND

Primary Roads 
Secondary Roads 
Proposed Roads 



See Detail Map

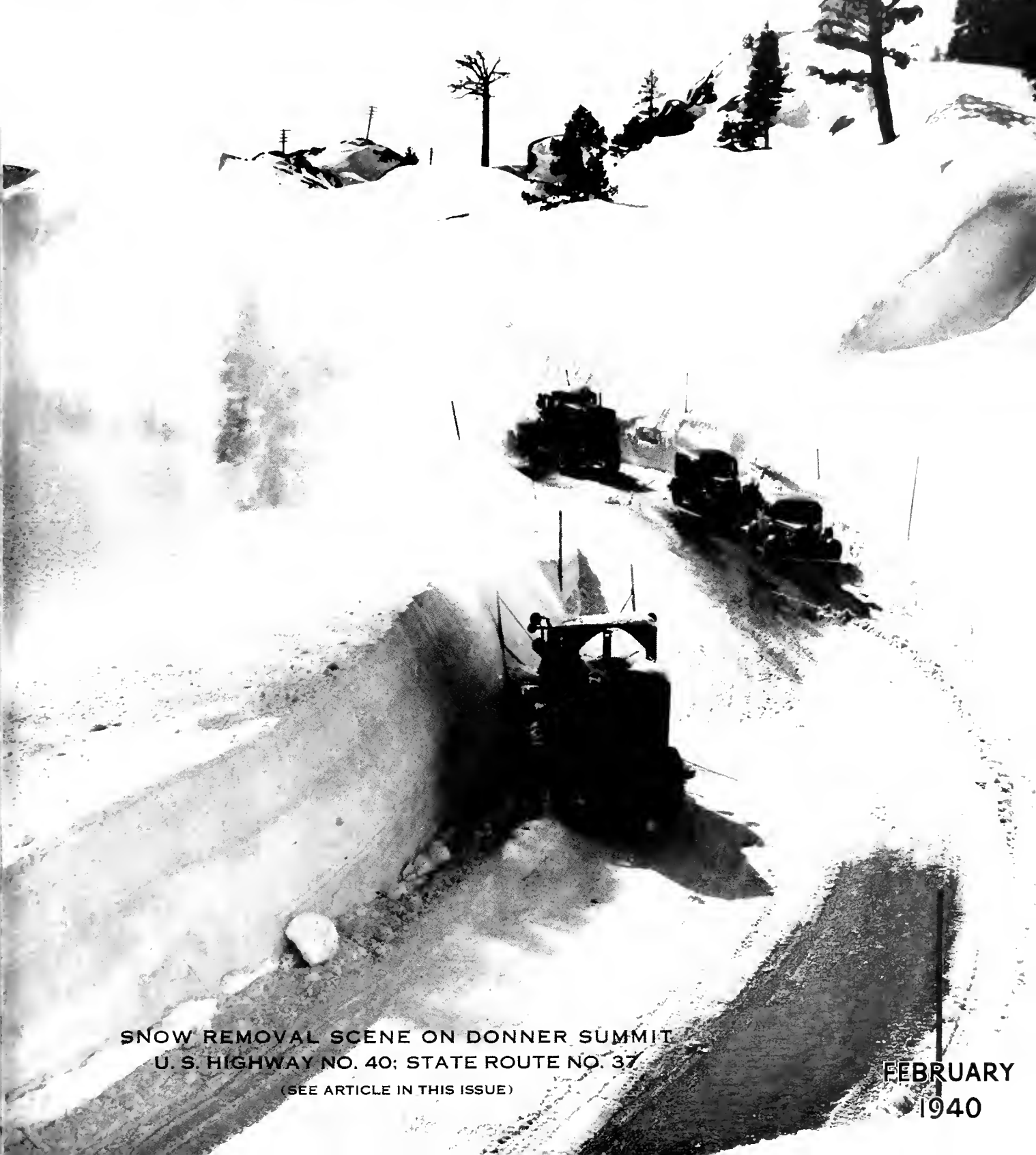
SAN FRANCISCO AND VICINITY

See Detail Map

LOS ANGELES AND VICINITY

CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



SNOW REMOVAL SCENE ON DONNER SUMMIT
U. S. HIGHWAY NO. 40; STATE ROUTE NO. 37

(SEE ARTICLE IN THIS ISSUE)

FEBRUARY
1940

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

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Governor Olson Asks Solons to Unfreeze \$50,000,000 Central Valley Project Bonds

IMPORTANT developments affecting the Central Valley Project moved in swift succession during the last month. In Washington, D. C., President Franklin D. Roosevelt made a supplemental recommendation to the Congress asking an additional \$6,000,000 for construction work on the Central Valley Project during the present fiscal year. The President previously had recommended to Congress an appropriation of \$16,000,000 to carry on the work this year. The figure was \$6,000,000 less than the \$22,000,000 which engineers of the United States Bureau of Reclamation had determined was the minimum amount on which the construction could be carried out without interruption or delay and brings the President's recommendations up to the engineers' estimates.

In California, Governor Culbert L. Olson, in compliance with requests from the Federal Government and numerous local groups, included in the agenda for the special session of the Legislature an amendment to the Central Valley Project Act which would unfreeze up to \$50,000,000 of the revenue bonds authorized by the act.

Enactment of the legislation would place the Water Project Authority in a position to provide supplementary works necessary to make the project operative and thus effectively assume the responsibility which the Federal Government repeatedly has pointed out is the duty of the State.

Specifically, the proposed amendment is designed to accomplish the following:

1. To authorize the Water Project Authority to issue up to \$50,000,000 of the \$170,000,000 bond authorization of section 18 of the act, notwithstanding any restriction or limitation contained in section 18.

2. To limit the authorization to purposes and objects of the act as may be requested or approved by the Secretary of the Interior.

3. To provide adequately for successive and independent bond issues.

Complete Text of The Central Valley Project Bond Bill

An act to add section 18a to the Central Valley Project Act of 1933, relating to the issuance of revenue bonds by the Water Project Authority of the State of California.

The people of the State of California do enact as follows:

Section 1. Section 18a is hereby added to the Central Valley Project Act of 1933 to read as follows:

Sec. 18a. In order to carry out and perform such of the purposes and objects of this act as may be requested or approved by the Secretary of the Interior of the United States, the Authority, notwithstanding any restriction or limitation contained in section 18, is authorized and empowered to issue a portion of said bonds authorized by said section 18, in a total sum of fifty million dollars, or so much thereof as may be necessary therefor. Notwithstanding any provision of this act inconsistent herewith, successive issues of bonds within the limits of the authorization contained in this section shall have preference with respect to the redemption thereof and the payment of interest thereon and the lien thereof upon revenues as the Authority in its discretion shall determine.

In his message to the Legislature concerning the amendment, Governor Olson declared:

"I have considered carefully whether legislation could be further delayed until the next regular session

without injury to the public interest and without ignoring the requests received from the Federal administration. I am convinced that can not be done and that the need for this legislation is so urgent that it would be a dereliction of duty on my part if I failed to include it in the subjects submitted for your consideration.

"The Federal Government will surely complete this project if California will do the things needed to be done and give the people its full benefit in the delivery to them, at the lowest possible cost, of the water and power from this project. That objective can only be obtained through public distribution.

"The proposed amendment in simple language would free up to \$50,000,000 of the \$170,000,000 of revenue bonds authorized in the present act, to be used by the State in carrying out the purposes and objectives of the act itself. It would place the State in a position to contract with the Federal Government for distribution of the electric power developed by the project, instead of leaving the Federal Government and the people to be served at the mercy of a private power distribution monopoly which would be its only purchaser.

"Federal Government officials are well aware of the need for haste in having this legislation enacted. They know the inevitable delays which follow if the distribution and marketing features of a project are left untouched until the project is completed. The Federal Government and the people suffered loss from delays in providing for public distribution of power upon the completion of the Bonneville project in the State of Washington. Such a condition in California should be prevented by your action at this session."

During January, the Water Project Authority held three important meetings. At the first of these, held on January 16, the authority members found there were so many important matters on the agenda a second meet-

ing would be necessary to consider them all.

They adopted a resolution urging Congress to enact legislation to provide appropriations of \$30,000,000 to

carry on construction work on the Central Valley Project during the next fiscal year; authorized giving legal assistance to the Bidwell Municipal Utility District in defending a suit

to quiet title to its property and continue distribution of water to the town of Durham, and adopted a resolution recommending that the reservoir created by Shasta Dam be named Lake McColl in honor of the late Senator John B. McColl of Redding.

Communications from the East Contra Costa Irrigation District, the Modesto Irrigation District, The Public Ownership League and resolutions from the California Municipal Utilities Association and the city of Roseville urging that the authority concern itself with providing public means

From Coram a second conveyor system, built by the Pacific Company, will carry the aggregates up the side of the canyon to the concrete mixing plant at the top of the dam site.

Shasta Dam Aggregate Conveyor Belt, Longest in the World, Will Carry 22,000 Tons Daily 9.6 Miles Over Hills and Valleys

WITHIN a few weeks California will have another "first" to add to her already imposing galaxy of super-colossals. The new-comer will be the longest conveyor belt system in the world. It is being built to transport aggregates from gravel deposits at Redding to Shasta Dam.

Work on the conveyor system is being rushed to completion and it is anticipated it will be in operation early in March in ample time for the beginning of concrete pouring at the dam. The conveyor will be 9.6 miles long, cutting across the hills and valleys in an almost straight line from

Redding to Coram. Another conveyor system, more than a mile long will be used to carry aggregates from pits at Coram up the steep sides of the canyon to base of head tower where concrete for dam will be mixed.

The Columbia Construction Company, which has the contract for preparation of the aggregates, has completed its washing and grading plant at the gravel deposits just east of Redding. A subcontract for furnishing 16,000 trough and return belt idlers, or rollers, was awarded by Columbia to the Chain Belt Company of Milwaukee, Wisconsin. About 18

miles of steel tubing, 11 miles of steel shafting, 10½ miles of angle iron, 50,500 malleable castings and 83,000 anti-friction roller bearings are required for the idlers.

A second subcontract for the manufacture of more than 20 miles of 36-inch, six-ply belting was awarded to the Goodyear Tire and Rubber Company of Akron, Ohio. Almost 1,000,000 pounds of rubber and more than 1,000 bales of cotton are required.

Most of the framework for the conveyor is of wood construction. One canyon crossing requires 90-foot steel

(Continued on page 4)

of power distribution were received and filed without action.

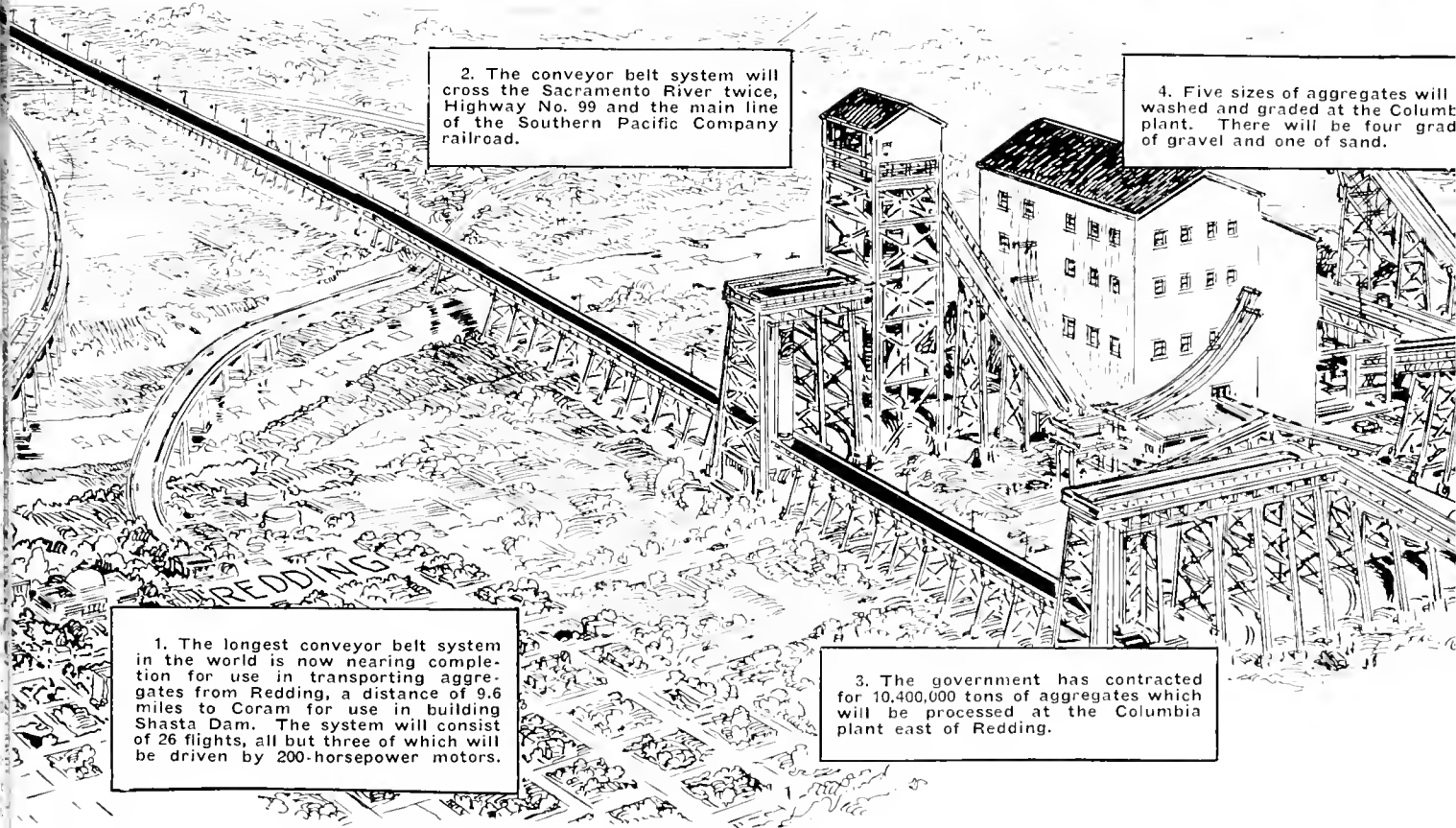
Stephen W. Downey, attorney for the Sacramento Municipal Utility District, presented a written statement asking the authority to make the district a firm offer on energy from the Central Valley Project.

In addition representatives from a number of valley irrigation districts and other agencies made verbal requests that the authority take steps to provide them with power from the project. Among those appearing were W. F. Wooley on behalf of the West Stanislaus Irrigation District and five other west side districts in the lower San Joaquin Valley; George K. Anderson of the Byron Bethany Irrigation District; Felix Swan of Reclamation District 2068; F. R. Reyner of the Banta Carbona Irrigation District; L. L. Miller of the Central San Joaquin Municipal Utility District and John Henning representing the city of Lodi.

Clarence Breuner and Roland Curran of Sacramento, and Thomas M. Carlson of Richmond, members of the Central Valley Project Association, spoke in opposition to the enactment of any State legislation at the special



Photograph of partially completed section of conveyor belt system.



session which would permit the authority to assist the Federal Government in making the project operative.

In view of the importance of the proposed legislation, the authority set it for a special hearing on January 22. Opposition to the legislation received wide publicity, with the result that approximately 200 farmers, representing all sections of the Central Valley, came to the hearing. The board room in the Public Works Building was much too small to accommodate them and the meeting was transferred to the Assembly Chamber in the Capitol.

State Grange Master George Sehlmeier, representing 25,000 farmers in the State, told the authority his organization would fight any effort on the part of the authority to make the Central Valley Project a "water conservation plan that does not include the development and distribution of power."

"Power must take the majority of the load," he declared, "and we must have public outlets for that power in order to get competitive bidding and build the revenue from power up to the point where it will carry its share of the load. The California State Grange and these farmers are requesting that public outlets for power be made available."

In the all-day hearing, farmer after farmer took the floor to stress the need for early action on the part of the authority to provide the means for public distribution of the power from the Central Valley Project. Irrigation district representatives from the lower San Joaquin Valley declared that the only reason the project was approved in that part of the State was on the promise of cheap power through public distribution.

Farmers from the Sacramento Valley, from which surplus water is being transferred to the San Joaquin Valley, asked in exchange that power be served to them from the project by the State.

Again members of the Central Valley Project Association, Clarence Brenner of Sacramento, Thomas M. Carlson of Richmond, Harry Barnes of Madera and James Fauver of Exeter reiterated the opposition of their association as presented at the previous meeting.

At the end of the day-long session, the farmers stayed on to organize a new committee dedicated to furthering the interests of the Central Valley Project. The organization adopted the

name of the Citizens' Central Valley Committee and unanimously went on record urging Governor Olson to include the proposed legislation in the agenda for the special session of the Legislature.

Two days later the Water Project Authority met again and after hearing statements from members, Attorney General Earl Warren and State Treasurer Charles G. Johnson, opposing introduction of the legislation at the special session, voted two-to-two on the proposition. Chairman Frank W. Clark and State Director of Finance John R. Richards voted aye and Attorney General Warren and Treasurer Johnson voted no. The fifth member of the authority, State Controller Harry B. Riley, was absent.

The authority approved the work program being carried on by the Division of Water Resources in its behalf and authorized the preparation of a test case to secure a decision by the Supreme Court of California that a public district, corporation or municipality owning and operating or contemplating owning and operating an electric power distribution system may compel a privately owned public utility serving the same territory to furnish electric energy to such publicly owned system.

Belt to Tote 22,000 Tons Daily

(Continued from page 2)

bents. The belt line will cross the Sacramento River twice, pass over U. S. Highway 99, the main line of the Southern Pacific, five county roads and four creeks.

The conveyor system will consist of 26 flights. Each flight will be operated by a 200-horsepower motor except the last three. These are located on a 25 per cent down grade on the east slope of the Sacramento River Canyon and will be equipped with motor generators which can utilize the potential energy of the loaded belt to generate power to help pull the aggregates up the other side of the hill. The entire system will be illuminated by sodium vapor lamps.

The estimated maximum daily aggregate requirement at Shasta Dam is to be 16,000 tons of gravel and 6,000 tons of sand. The capacity of the belt system is to be 1,100 tons an hour at a speed of 550 feet per minute.

F. R. Sachse Made Assistant Director of Public Works



FRANZ R. SACHSE

Governor Culbert L. Olson on February 6 announced the appointment of Franz R. Sachse of Los Angeles as Assistant Director of the Department of Public Works.

Mr. Sachse, who has been engaged in the practice of law in Southern California since 1933, will take over the duties of chief assistant to Director of Public Works Frank W. Clark. Educated in the public schools of California, Mr. Sachse is a graduate of Stanford University.

As a member of the executive board of the Municipal League of Los Angeles and of the executive body of the Los Angeles Chapter of the National Lawyers' Guild, Mr. Sachse has been prominent in civic affairs in Southern California.

The new assistant director is the son of Richard Sachse, Director of the Department of Natural Resources. He will make his home in Sacramento with his wife and four year old daughter.

"The Department of Public Works is fortunate in securing the services of Mr. Sachse," Director Clark said. "He will be of great help to me and to the department and a credit to Governor Olson's administration."



Auger blower rotary plows at work during night on Donner Summit highway (U. S. 40) clearing and keeping it open for traffic.

Costs of Snow Removal in Relation to Traffic

By T. H. DENNIS, Maintenance Engineer

EACH winter, approximately 3400 miles of State highways which traverse the high mountain areas are cleared of snow so that normal communication and travel will be possible. The magnitude of this task is apparent from the size of the annual bill, which has varied from \$390,000 during a mild winter, to as much as \$575,000 during a severe winter—the average cost for the last three years being \$482,000 per season.

Expenditures for snow removal add up to such a substantial amount, and there is such an increasing demand for this winter service, that a question is suggested as to whether the benefits resulting from this work justify the expense. A definite answer to this question is hardly possible. It would be exceedingly difficult even to

list all the various kinds of benefits which derive from open highways. However, an analysis of snow removal costs on the State highway system has produced some interesting data, which is at least pertinent to the subject.

The State highway routes included in the present snow removal program may be classified into two groups, according to the predominating type of traffic which uses the road. One group includes the main line or through routes, and the second group comprises those routes which carry purely recreational traffic.

DIFFERENCE IN COSTS

In investigating snow removal expenditures, it has been found that, while there is a wide divergence in costs between various individual

roads, the average unit cost incurred on the purely recreational routes has been considerably in excess of the average cost incurred on the through routes. This is due primarily to the highly intermittent character of recreational traffic. Daily winter traffic on the main highways, even through snow country, conforms more or less closely to a fixed pattern, and is fairly constant. Winter recreational and snow sport travel, however, is very sensitive to conditions which effect winter sports, particularly the weather, and is spasmodic.

AVERAGE TRAFFIC FLOW

This type of traffic usually reaches peak flow on week ends and holidays, with a comparatively small travel, often practically nothing, throughout



Scene on U. S. 40 in snow sports area of Nevada County near Soda Springs.

the balance of the week. In spite of the popularity of certain winter sports areas, average daily traffic on recreational roads during the winter months is low, and consequently unit costs per vehicle mile for snow removal on those routes are high.

High snow removal costs on a route in relation to traffic volume do not, of course, necessarily indicate that the expenditures are unwarranted. In general, the cost of clearing snow should have some relation to the volume of travel on the road. There are, however, other factors of an economic and social nature which may tend to justify an all-year highway service, which would not be warranted on the basis of highway travel only.

This analysis of the cost of snow removal on the State highway system is based on average costs incurred during the last three years, and upon the classification of State highway routes according to the purpose served by the snow clearing operations—that is, whether traffic is through or purely recreational.

In the first group of roads there are 2838 miles of State highway, which are normally cleared of snow to maintain travel between county seats or centers of population, or to serve important or through traffic. The average cost of clearing these routes has been \$368,454 per season. By applying the seasonal percentages ascertained from monthly recount stations to the traffic volumes obtained in the regular counts, it is estimated that approximately 90,727,000 vehicle miles are generated on this road mileage during the months of January, February and March. Thus on the through routes and connections, the average unit cost for snow removal has been \$4.06 for 1000 vehicle miles of snow territory travel.

Costs on certain routes have been considerably in excess of this average. For example, it is estimated that 6,606,000 vehicle miles are generated on the Donner Summit highway during the winter quarter (a portion of this is recreational), and the cost of clearing snow on this route has amounted to \$12.52 per 1000 vehicle miles. Traffic on the Red Bluff-Susanville highway is estimated at 2,520,000 vehicle miles for the winter quarter and snow removal on this route has cost \$13.94 per 1000 vehicle miles.

In the second group of roads, there are 555 miles of State highways which are cleared of snow each win-

ter solely for recreational purposes. None of these routes connect centers of population or serve through traffic, the primary purpose of the snow removal operations being recreational.

The average cost of clearing these roads has been \$113,626 per season. On the basis of the regular snow counts where available, or where no snow counts have been taken, by the application of monthly percentages to the total annual traffic, a close approximation has been made of the vehicle miles generated on these 555 miles of highway during the winter quarter. It is estimated that this travel amounts to approximately 10,306,000 vehicle miles during January, February and March, and the average unit cost per snow removal on the purely recreational roads has been \$11.02 per 1000 vehicle miles of snow territory traffic.

Here again unit costs on certain routes have considerably exceeded the group average. For example, costs on the Wrightwood-Big Pines Camp road have been \$19.18 per 1000 vehicle miles, on the Big Bear Lake road, \$12.35 per 1000 vehicle miles, and on Route 83, Burney to Lassen Park, \$35.79 per 1000 vehicle miles.

GAS TAX COMPARISONS

How do these unit costs for moving snow compare with the gasoline tax revenue earned by these routes during the winter months? It has been found that the average gasoline consumption per automobile is about $13\frac{1}{2}$ miles per gallon, and 1000 vehicle miles, therefore, represents the purchase of 74 gallons of gas. The tax paid on this amount of gasoline, at 3 cents per gallon, is \$2.22 per 1000 vehicle miles. The Division of Highways' portion of this revenue is $1\frac{1}{2}$ cents per gallon or \$1.11 per 1000 vehicle miles, and this earned revenue compares with an average snow removal cost of \$4.06 per 1000 vehicle miles on the through routes, and \$11.02 per 1000 vehicle miles on the recreational routes.

Obviously, traffic through snow territory by no means pays its way, but on the contrary a generous contribution from the average motorist is required to keep the through routes open and an exceedingly liberal subsidy is required to keep the recreational routes open.

It is to be noted that the unit costs for snow removal, stated above, have been calculated on the basis of the traffic generated only on the road



Groups of skiers arriving on Donner Summit for day's sport.



Truck equipment slicing down high snow bank on Donner Summit Highway

mileage actually cleared of snow. There is, of course, a considerable volume of travel on highways leading to the snow routes which is induced by the fact that these snow routes are kept open. This tributary traffic may be regarded as contributing to some extent to the revenue earned by the snow routes, as undoubtedly some of this travel is over and above what would otherwise occur. There is, however, no way of estimating the extent of such traffic or earnings.

The volume of traffic which traverses those routes on which heavy snow removal costs are incurred appears, also, to be very small in relation to the funds allocated to keep the roads open. It is estimated that there were generated in 1938 on the rural State highway system an average of 19,000,000 vehicle miles per day, and that a total of 1,453,500,000 vehicle miles occurred during the months of January, February and March.

During these three winter months, 90,727,000 vehicle miles, or 6 per cent of the total State traffic, occurred on the through routes on which snow removal operations were carried on. In the same three months, 10,306,640 vehicle miles, or 0.7 per cent of the total State traffic, occurred on the routes which were cleared of snow for winter sport and recreational purposes.

In an average year over 5 per cent of all funds budgeted for State highway maintenance purposes is expended for clearing snow on roads

which carry only 1.4 per cent of the total annual highway traffic, and 1.3 per cent of all maintenance funds are expended for clearing snow on the purely recreational routes, which carry only 0.15 per cent of the total annual traffic. It would seem that the snow sport enthusiasts are being well provided for, in so far as service on State highways is concerned.

There is one conclusion which can be drawn from these figures which is not controversial—clearing snow from highways is expensive. The following tabulations list the State highways now cleared, their classification as recreational or through routes, and the average expenditures for snow removal on each road for the past three winters:

AVERAGE SNOW REMOVAL COST ON ALL STATE HIGHWAYS EXCLUDING RECREATIONAL ROUTES

Route	Road	Road Miles	Average Cost Snow Removal
1	Crescent City-Grants Pass...	43.6	\$1,833.67
20	Blue Lake-Redding	141.7	5,575.81
84-46	Willow Creek-Yreka	155.1	1,764.69
35	Altton-Red Bluff	102.2	2,766.48
1	Willits-Cummings	43.4	645.45
89	Middletown-Lakeport	19.6	746.80
3	Redding-Ashland	124.9	21,550.77
72	Weed-Klamath Falls	62.2	6,243.09
28	Redding-Alturas-Stateline	174.5	19,872.07
29	Red Bluff-Susanville-Reno	184.1	35,117.34
21	Feather River Highway	116.0	12,741.82
73	Susanville-Oregon Line	141.1	8,042.80
82	Etna-Montague	34.2	2,373.81
83	Mt. Shasta City-Hat Creek-Chester-Keddie-Sierra Co. line	123.1	19,342.72
35	Peanut-Douglas City	28.5	1,747.20
47	Deer Creek Road	55.7	1,083.97
37-38	Donner Summit	89.6	82,705.96
11	Placerville-Echo Summit	47.9	7,047.26
38-39	Lake Tahoe Roads	56.4	19,375.71
83	Truckee-Sierraville	39.3	3,999.28
25	Colfax-Grass Valley-Downieville-Sattley	87.8	12,949.66
17	Auburn-Nevada City	25.5	342.82

Route	Road	Road Miles	Average Cost Snow Removal
57	Bakersfield, Isabella-Freeman	64.4	\$981.88
4	Ridge Route	33.8	4,702.05
58	Tehachapi Route	49.7	1,297.98
41	Kings River Canyon	11.6	4,362.57
59	Gorman-Lancaster	16.2	94.59
138	Ventura-Maricopa	33.0	190.34
61	Carlton Flats Road	8.4	584.18
62	San Gabriel Canyon	14.3	508.17
59	Palmdale-Cajon	30.3	691.88
31	Cajon Pass	30.0	860.93
26	San Geronimo Pass	14.6	59.33
31	Barstow-Las Vegas	14.0	515.26
64	Hemet-Keen Camp-Indio	30.0	1,099.24
23	Los Angeles-Reno	187.4	63,000.03
96	Bridgeport-Sweetwater	13.8	274.83
76	Bishop-Tonopah	41.6	888.59
63	Big Pine-Goldfield	18.0	927.55
40	Tioga Pass	14.6	1,396.33
13	Sonora Pass	59.5	745.31
40	Benton Station-Benton	8.7	315.61
76	Camp Sabrina Road	17.6	2,912.51
34	Carson Pass	57.1	2,765.71
23	Luther Pass-Woodfords-Mark-Jeewille	31.7	3,427.06
24	Ebbetts Pass	65.3	2,294.26
40	Big Oak Flat Road	21.2	510.20
12	San Diego-El Centro	24.0	1,596.91
78	Descanso-Julian-Santa Ysabel	25.0	3,138.12
198	Julian-Kane Springs	6.0	444.14
Totals		2,838.2	\$368,454.74

AVERAGE SNOW REMOVAL COST ON STATE HIGHWAYS FOR RECREATIONAL PURPOSES

Route	Road	Road Miles	Average Cost Snow Removal
20	Redding to Lassen Park	35.9	\$1,600.24
83	Burney to Lassen Park	21.2	1,365.85
15	Nevada City-Emigrant Gap	27.1	18,092.62
11	Placerville-Kyburz	30.3	5,264.25
125	Coarsegold-Yosemite	19.3	3,976.05
76	Toll House-Huntington Lake	35.1	7,356.80
41	Dunlap-General Grant Park	20.4	4,144.14
129	Badger-General Grant Park	15.0	553.09
127	Camp Nelson Road	29.1	232.87
142	Glennville-Isabella	43.5	1,676.25
61	Wrightwood-Big Pines Camp	8.7	4,505.99
43	Big Bear Lake Road	71.4	32,573.20
59-189	Lake Arrowhead Road	39.8	6,270.06
188	Camp Seeley Road	11.8	1,127.58
190	Camp Angelus Road	20.3	3,853.02
111	June Lake Road	15.6	3,426.14
112	Mammoth Lake Road	8.3	3,583.26
34	Pine Grove-Antelope Springs	15.5	1,035.07
24	Murphy's-Camp Connell	19.0	5,401.78
13	Pooleys-Strawberry	22.3	6,001.41
40	Groveland-Cliff House	14.6	754.91
18	Mariposa-Yosemite	30.8	831.65
Totals		555.0	\$113,626.23

Another phase of this snow problem concerns the State's investment in plant and equipment. When the Division of Highways undertakes to keep a highway open through snow country, it assumes a heavy responsibility, and it is imperative that proper and adequate equipment be available to insure, at all times, the safety of traffic using the route.

As of November 30, 1939, the inventory value of all snow plows operating on the State highway system amounted to \$492,488 and the value of trucks engaged in snow removal work amounted to \$582,919. In addition, numerous light vehicles and miscellaneous equipment amounting to between \$150,000 and \$200,000 are used, the total investment in equipment used for snow removal being over \$1,200,000.

The investment in maintenance stations and plant facilities chargeable to snow operations is difficult to seg-



These views indicate necessity of parking regulations on snow roads as enacted by the last Legislature. The upper picture shows the highway kept open in a controlled area and below a traffic jam in an area without control.

regate, but the figure is substantial. In connection with snow fighting, it is also very important that continuous communications be maintained between areas subject to heavy snow-fall and the lower elevations. There have been instances where failure of the regular channels of communication and lack of information as to conditions along the routes have resulted in serious delays.

To supplement other means of communication, radio facilities are now being installed in all districts where deep snow or severe storm conditions are likely to create a hazard, and continuous communication will be possible with the various field offices and even with the rotary snow plows at work on the roads. The investment in this radio equipment will be approximately \$60,000.



Highway Improvements in 1939 Exceeded Those of Previous Year

THE CALENDAR year of 1939 included the last six months of the biennial budgetary period ending June 30, 1939, and the first six months of the current biennial period which began on July 1, 1939, and ends June 30, 1941. Since the final months of a biennium are devoted ordinarily to getting under way the few remaining projects budgeted for that period and various unavoidable contingencies normally tend to retard progress at the start of a two-year program, the year 1939 might well have been expected to show a relative reduction in highway progress in comparison with 1938.

The records of the Division of Highways indicate, that while a reduction in the total estimate cost of contract work initiated in 1939 did occur, and that the number of construction and maintenance contracts awarded was 213 as compared with 216 in 1938, from the standpoint of mileage, improvements undertaken in 1939 were actually in excess of those in either 1937 or 1938.

This circumstance reflects in concrete fashion the success which has attended the efforts of those charged with the administration of the department to so arrange its activities that highway development in California may progress in uniform fashion to the end that the most efficient and economical use may be made of available funds and facilities.

During 1939, construction work was started on projects providing for a total of 1228 miles of highway to be graded, surfaced, paved or oiled and for construction of 110 bridges and grade separations.

The following tabulation shows various types of improvement initiated during the year together with the mileage involved:

Type of Improvement	Miles
Pavement	34
Plant-mixed surfacing	130
Road-mixed surfacing	103
Oiled Gravel	93
Armor coat and retread	123
Penetration oil and seal coat	343
Untreated gravel	12
Graded roadbed	3
Dust oil roadbed	314

Type of Improvement	Miles
Shoulder construction	73
Bridges and grade separation	(110)
Total	1,228

The degree to which the year's work was distributed throughout the entire State may be gauged from the fact that one or more contracts were awarded for projects in each of 55 of the State's 58 counties.

The wide range and diversity of character of highway projects undertaken in 1939 is indicated in the following brief descriptions of a few of the larger and more important improvements.

On the Pacific Highway, U. S. 99, north of Redding, work was started on two major projects comprising a portion of the relocation of 15 miles of this highway required to clear the flooded area which will result from the building of the Shasta Dam unit of the Central Valley Project now under construction.

One of these contracts provides for the construction of a four-mile section of the relocated highway in the vicinity of the Pit River beginning at a point about 12 miles north of Redding. The other involves the construction of a bridge on the new highway alignment over the Sacramento River at Antler. This bridge will be 1330 feet long with a roadway fifty feet wide and will cross the river channel at an elevation 210 feet above the river bed.

The relocation of the entire 15 miles of this highway is being performed in cooperation with the U. S. Bureau of Reclamation.

GRADE SEPARATIONS

In cooperation with the Federal Government and the various railroads, contracts were awarded during 1939 for grade separation structures in or near Los Angeles, Turlock, Berkeley, Palm Springs Station, Pomona and Palo Alto. At Firebaugh in Fresno County a grade crossing is being eliminated by rerouting the State highway through the city.

In Santa Clara County work began in the closing days of the year on the

last link in the construction of the highway between Santa Cruz and Los Gatos. The construction of this final two-mile section between Oaks Road and Los Gatos will complete a program first begun in 1933 looking toward the complete replacement of the totally inadequate original road with a through route of modern grade, alignment and width.

DIVIDED HIGHWAYS

To meet the urgent requirements of increased traffic volume on the State Highway System for modern divided highways several projects of this type were started in 1939.

One contract for the reconstruction of an additional stretch of the Coast Highway between Oxnard and Santa Monica provides for an increase of 3.7 miles in the portion of this route constructed with a central dividing strip.

Through the suburban area east of San Diego between La Mesa and El Cajon construction was begun during the year on a four-mile section of divided highway on U. S. Route 80.

Extending northerly for 1.7 miles from the City of Merced on U. S. 99 work is in progress on a contract for divided 4-lane construction. On this project the present two-lane pavement will be preserved intact throughout the major part of the project. To provide a 4-lane traveled way a separate two-lane road is being built on a slightly higher grade east of the present roadway.

ARROYO SECO PARKWAY

Five separate contracts were awarded during the year in continuance of the program for construction of the Arroyo Seco Parkway. When complete this development is designed to afford a high speed freeway for the great volume of traffic between Los Angeles and Pasadena.

Other important work undertaken during the year includes the pavement of a six-mile stretch of the Pacific Highway, U. S. 99-W, from Red Bluff southerly; grading and surfacing of 3.4 additional miles of the Mint Canyon Short Cut on the new align-

Director Clark Signs His Name On 71,000 Bonds

SIGNING his name at the rate of 15,000 times on each day he devoted himself to the task. Director of Public Works Frank W. Clark during the last three weeks has been engaged on five separate days in attaching his signature to \$71,000,000 worth of San Francisco-Oakland Bay Bridge bonds.

Using a multiple signing device, Mr. Clark has been able to sign twenty bonds at a time. He was completing his monumental job when this issue of California Highways and Public Works went to press.

The work of signing the bonds should be completed by February 15 in order that they may be distributed to bond holders prior to March 1.

The bonds will replace temporary ones issued last summer when a group of bond houses purchased from the Reconstruction Finance Corporation the entire San Francisco-Oakland Bay Bridge bond issue.

This issue has been resold by the bond houses and the new bonds will be delivered to the purchasers by the San Francisco Bank, fiscal agent of the California Toll Bridge Authority after Mr. Clark and the bank have signed them.

The Reconstruction Finance Corporation originally financed the building of the bay span, holding as collateral bonds of the State of California, and then disposed of the issue to bond houses which sold them to the public.

The bonds pay 4 per cent interest.

ment of State Route 23 in Los Angeles County; reconstruction of 7 miles of the Redwood Highway in Mendocino County between Hopland and Ukiah; improvement of 7.3 miles of the Coast Route in Monterey County along the Salinas River between Bradley and the San Luis Obispo County line; grading and surfacing 9 miles of the Redding-Alturas Lateral between Adin and Canby in Modoc County; and the relocation of 6 miles of the Sacramento-Placerville Road U. S. 50 between Folsom and Clarksville.



FRANK W. CLARK, Director of Public Works
At duplicating machine signing his name 15,000 times a day on Bay Bridge Bonds

Low Tolls Boost Bay Span Traffic

ATOTAL of 849,910 vehicles crossed the San Francisco-Oakland Bay Bridge in January, 1940, Director of Public Works Frank W. Clark reported to Governor Culbert L. Olson.

This was 13.9 per cent in excess of the figure for January a year ago.

If the traffic to Treasure Island is excluded, the resulting net bridge traffic over the previous January shows an increase of 21.7 per cent. Some of this is attributable to a natural healthy growth, but the majority of it has resulted from the two substantial toll reductions effected during the last year. The present toll is

29.2 per cent less than it was 12 months ago.

The 35-cent toll on autos created an unprecedented demand for nickels and dimes. The coin wrapping machine at the toll plaza handled 1,008,000 coins during the month.

The elimination of the charge for extra passengers in automobiles and the substitution of a truck toll based on gross weight, in lieu of the former combination toll for truck and net weight, have both proved a big boon in handling traffic at the toll plaza. This has particularly facilitated the speed of handling trucks.

January totals and comparative figures were:

	Jan. 1940	Jan. 1939	Dec. 1939	Total Since Opening
Passenger Autos and Auto Trailers.....	772,440	667,648	776,625	28,444,728
Motorcycles and Tricars.....	2,471	2,774	2,824	132,173
Buses.....	16,469	13,105	16,596	457,421
Trucks and Truck Trailers.....	41,798	43,651	42,816	1,360,847
Others.....	16,732	18,917	15,552	479,362
Total Vehicles.....	849,910	746,095	854,413	30,874,531



Before and after channelization of East 18th Street and Lakeshore Avenue, Oakland, along south shore of Lake Merritt.

Channelizing Traffic In Oakland

By GEORGE MATTIS, Engineer, City Cooperative Projects District IV

THE many recurring accidents, both to vehicular and pedestrian traffic, at street and highway intersections have led to an intensive study by highway and municipal engineers everywhere in an effort to determine adequate measures to reduce accidents at these danger zones.

The Division of Highways has created a Department of Safety which is now actively working on the problems of safety for highway traffic through-

out the State. The larger cities have also inaugurated Safety Departments which are now actively attempting to solve the traffic problems created by the ever-increasing traffic on their streets.

In the City of Oakland, this problem has been assigned to a Traffic Committee composed of certain city officials and representatives of important civic organizations. Frank C. Myers has been designated as Acting Traffic Engineer and, in cooperation

with John G. Marr, City Planning Engineer, has designed and the city has constructed, 12 channelization projects under the supervision of City Engineer Walter N. Frickstad.

These improvements were constructed as a cooperative project with the State $\frac{1}{4}$ cent gas tax allocation to cities for streets of major importance and with WPA funds and personnel. No attempt was made to segregate the costs for each project as in most cases the work was a part of a larger



El Embarcadero between Grand Avenue and Lakeshore Avenue, a wide, high traffic count street transformed into 2 lanes separated by a small park.



Grand Avenue and Harrison Street intersection, first marked with painted line and then channelized as shown at right.

project of street widening and resurfacing.

The 12 channelization projects already completed are located at the following street intersections:

1. Broadway and Patton Street.
2. Grand Avenue and Harrison Street.
3. Broadway and Landvale Road.
4. 55th Avenue and Camden Street.
5. Camden Street and Seminary Avenue.
6. Excelsior Avenue and Athol Avenue.
7. Van Buren Avenue and Perry Street.
8. Santa Clara Avenue and Grand Avenue.
9. 14th Avenue and East 12th Street.
10. 98th Avenue and San Leandro Street.
11. East 18th Street and Lakeshore Avenue.
12. El Embarcadero, between Grand Avenue and Lakeshore Avenue.

To those familiar with Oakland's street system, it will be noted that

eight of these projects are on State highway routes and four on major streets only. Strangely enough, the larger projects are not on State highway routes.

The two largest and most comprehensive projects are designated as No. 11, East 18th Street and Lakeshore Avenue, and No. 12, El Embarcadero, between Grand Avenue and Lakeshore Avenue. Project No. 9, 14th Avenue and East 12th Street, which is on State Highway Route 105, might be considered of major importance because of its size and cost, but as now constructed, is only considered a temporary development to provide relief until a more comprehensive project can be financed.

In determining the projects for channelization, the committee emphasized particularly the problems of traffic control and movement, special emphasis being placed upon the fac-

tors causing accidents, the time of greatest accident frequency, type of accident, physical conditions of the street system, and the effect channelization would have upon future development.

The size, shape, and general design of the channelization is determined by the topography of the intersection, giving full consideration to the direction the traffic desires to go. In all cases, a design is prepared by the Acting Traffic Engineer and approved by the City Engineer and City Planning Engineer before being submitted to the committee as a whole. When the design is finally approved, the channelization is constructed as designed.

In one case, the intersection at Broadway and Patton Street, the design was painted upon the pavement with white water paint and traffic was directed to follow the lanes as out-

(Continued on page 18)



Broadway and Patton Street intersection as it looked before and after traffic was plainly directed by channelization.

Administrative Problems of State Highway Maintenance

By T. H. DENNIS, Maintenance Engineer

This is the second installment of an address delivered by Mr. Dennis at the recent meeting of the State-wide Highway Committee of the California State Chamber of Commerce at the Palace Hotel in San Francisco.

MAINTENANCE expenditures have increased since 1934, but with the sole exception of 1938, when extraordinary storm damage occurred, such expenditures have been at a lesser rate than the growth of traffic, which has increased approximately 33 per cent, measured on the basis of fuel used. Maintenance expenditures have increased 24.2 per cent in the same period.

Tables 6 and 7 have been prepared to show the variation in expenditures from July 1933 to June 1939—a six-year period. Table 6 shows the proportion, expressed in percentage, of funds expended by years for each class of work. Table 7 shows the variation from year to year of the amount required by class of work.

The effect of the storms of 1938 is particularly noticeable on traveled way, shoulders and roadsides. Some of the shoulder repair was deferred and carried out in 1939. The general increase from year to year is attributable to several factors—to the increase in traffic for one thing; to the necessity for handling ever-growing traffic on pavements that are too narrow to

permit the most economical maintenance; and to the necessity of maintaining types of surface that are below the design required for the number of vehicles using the roads. In this connection, there is cause for concern not alone with the number of vehicles using the roads, but with their weights. Recent studies indicate that many roads are carrying heavier weights than was generally supposed.

SLIDE REMOVAL COSTS

There are incidental items of expense which appear of minor importance, but absorb an appreciable amount each year. A case in point is the cost of flagmen. During work on the travelled way on heavy traffic routes, it is now necessary to provide flagmen as a regular part of the operations in order to protect the workmen.

The largest single item in roadside charges is the cost of slide removal. This item reflects the severity of storm conditions, one year with another. It is influenced, also, by standards of construction.

In response to traffic demands, such

standards have been raised from year to year. This is exemplified in the expenditures for grading. In the years 1913 to 1923, only 37.8 per cent of construction cost was for grading. From 1934 to 1938, this item required 56.2 per cent of the funds expended. This increase in depth of cut and height of fill naturally has been reflected in a definite increase in cost of maintenance.

STABILIZATION RUNS HIGH

It is not economical to trim cut banks and slopes to their ultimate position at the time of construction. It is the accepted practice to trim them to reasonably safe limits and to take care of slides and subsidence through maintenance operations. It is not uncommon to spend \$50,000 or more for stabilization on a piece of new construction ten miles or less in length during this period of weathering. As an example, at Point Mugu on Route 60 a single slide of a half million yards occurred. Recurring slides are likewise encountered along the Redwood Highway, the San Simeon Highway, the San Marcos Pass,

TABLE 6
Variation in Maintenance Expenditure from Year to Year by Class of Work 1934 to 1939

Symbol	Expenditures Expressed in Percentage by Class of Work						Total Expenditures July, 1933, to June, 1939	
	1934	1935	1936	1937	1938	1939	Percentage 1934-39	Amount
Traveled Way.....	48.74	43.18	45.32	37.30	36.11	37.47	40.86	\$20,668,295.77
Shoulders.....	4.36	4.76	4.69	4.29	4.75	7.79	5.13	2,597,094.31
Road Sides.....	28.59	31.43	32.03	35.07	39.49	30.61	33.29	16,842,131.15
Structures.....	5.61	6.27	3.92	5.67	6.37	7.48	5.93	3,000,370.36
Safety Devices.....	5.24	5.05	5.51	5.53	4.86	6.74	5.48	2,771,175.69
Trees.....	1.69	1.65	2.10	2.26	1.88	2.55	2.03	1,026,635.51
Drifts.....	2.26	4.44	3.27	7.37	4.56	4.92	4.54	2,295,426.68
Miscellaneous.....	2.80	2.51	2.45	1.91	1.35	2.44	2.18	1,103,949.49
Engineering.....	0.71	0.71	0.71	0.60	0.63		0.56	281,854.34
Totals.....	100.00	100.00	100.00	100.00	100.00	100.00	100.00	\$50,586,933.30



Washout north of Ojai on the Ventura-Maricopa Highway in Ventura County during the storm of 1938.

the Angeles Crest, the San Gabriel Canyon, the Rim of the World and the Sharp's Park road south of San Francisco.

In addition to increased slide removal it is pertinent to mention here other increases inherent in the construction not commonly taken into account by the layman in considering maintenance expenditures. A typical example is the new route through Altamont Pass. This is a divided four-lane section, 56 feet wide, with heavy cuts and fills, as compared to the two-lane width of old road.

The cost of maintaining this new section for the year just past was \$958 per mile.

Another type of improvement that represents a direct increase in maintenance cost is the divided roadway, where the old road is retained in service to carry traffic in one direction. Typical examples are the sections north of Modesto, south of Merced and south of Bakersfield, all on U. S. 99. The cost of upkeep on the old sections of road is nearly as great as before and, in addition, there is the new section with shoulders on

each side, the extra width of right of way and all facilities for a complete two-lane road.

Roadside charges also include cost of weed and vegetation control. The expense of this work has increased from about \$70,000 in 1934 to \$136,000 in 1939. Weed control, under the law, is subject to recommendations by county horticultural commissions and is mandatory when so initiated.

Expenditures for bridges, while relatively not a large amount, are increasing from year to year. The number of weak or otherwise inade-

TABLE 7

**Variation in Maintenance Expenditures by Years for Each Class of Work
July, 1933, to June, 1939, Expressed in Percentage**

Symbol	Percentage by Years						Total 1934-39	
	1934	1935	1936	1937	1938	1939	Per cent	Amount
Traveled Way.....	16.44	16.43	17.82	14.92	18.69	15.70	100	\$20,668,295.77
Shoulders.....	11.72	14.42	14.67	13.65	19.56	25.98	100	2,597,094.31
Road Sides.....	11.84	14.67	15.46	17.21	25.08	15.74	100	16,842,131.15
Structures.....	13.05	16.42	10.62	15.60	22.71	21.60	100	3,000,370.36
Safety Devices.....	13.20	14.34	16.16	16.47	18.76	21.07	100	2,771,175.69
Trees.....	11.47	12.60	16.66	18.17	19.56	21.54	100	1,026,635.51
Drifts.....	6.88	15.21	11.57	26.53	21.24	18.57	100	2,295,426.68
Miscellaneous.....	17.70	17.85	18.01	14.25	13.06	19.13	100	1,103,949.49
Engineering.....	17.48	19.88	20.46	18.00	24.18		100	281,854.34
Totals.....	13.79	15.54	16.07	16.33	21.15	17.12	100	\$50,586,933.30

TABLE 8

High Maintenance Cost Roads During Year, June 1938-1939

Location	Miles	Type of surface	Cost per mile		Remarks on cost per mile
PLUMAS-21-A Butte Co. line to Howells	16.219	Oil gravel	TW	\$194.68	Routine maintenance
			RS	559.18	\$457 of this was slide removal and restoration work
			SD	72.67	Signs and traffic stripe
			T	13.22	
			D	42.17	Snow removal and sanding icy pavement
			M	44.92	A portion of this was pro rata charge due to radio
			Total	\$926.84	[station installation]
SAN MATEO-68-A So. San Francisco to San Francisco	3.496	P. C. C.	TW	\$380.15	Pavement 40'-60' wide
			SH	156.81	Including retreatment of raveled shoulders
			RS	1,080.72	\$854 of this item was due to slides
			SD	1,605.46	Mainly upkeep and operation of lighting system
				196.88	Traffic stripe renewal
				36.90	Install signs
			T	464.99	Trees and shrubbery upkeep
			M	9.89	
			Total	\$3,931.98	
HUMBOLDT-1-B Garberville to Miranda	11.217	Oil gravel	TW	\$784.13	This included retreatment of portions
			SH	6.39	
			RS	4,244.19	This included \$3,515.71 storm restoration
			S	21.38	
			SD	87.12	\$40 of this was for traffic stripe
			T	5.37	
			D	1.74	
			M	1.07	
			Total	\$5,151.39	
SACRAMENTO-11-D Bridge over Sacramento River N. of Isleton	0.120	Bridge	S	\$8,129.58	Operation of movable span
				1,914.08	Repairs and protection work
				1,378.97	Replace and modernize operating equipment
				11,965.26	Sand blast and painting (this work is required at
			SD	17.35	[intervals of not less than 10 years])
			M	514.87	
			TW	1.70	
Total	\$23,921.81	This is total and not per mile cost			
PLACER-37-C Placer Co. line to West end of Donner Lake	3.025	Rd. mix gravel	TW	\$1,409.25	Routine upkeep (on Donner Grade)
			RS	53.14	
			S	6.25	
			SD	123.19	This includes traffic striping and work on stock trail
			D	3,283.90	Snow removal [to divert stock travel
			M	333.98	Includes ventilating facilities and boiler in truck
			Total	\$5,209.71	[shelter]
SAN BERNARDINO-43-C Running Springs Park to Big Bear Dam	13.262	Rd. mix gravel	TW	\$1,225.02	Includes \$790 per mile for replacement, road mix and
			SH	8.75	[seal coat of portions
			RS	595.90	Includes slides, trimming, removal native trees, etc.
			S	183.76	
			SD	94.41	Includes \$44.89, cost of traffic striping
			T	4.62	
			D	676.65	Includes snow removal and sanding icy pavement
			M	23.93	
			Total	\$2,813.04	
RIVERSIDE-64-Q Jct. Rte. 87 west of Indian Wells to Jct. Rte. 26	10.130	Rd. mix gravel	TW	\$93.82	Includes retreatment of 6' oil shoulder
			SH	53.74	
			RS	185.28	
			S	596.44	Includes \$560 for repair and protection work at Deep
			SD	59.94	Mostly for traffic stripe [Creek]
			T	12.55	
			M	2.45	
			Total	\$1,004.22	
SAN DIEGO-2-B Encinitas to Oceanside	9.222	Asph. concrete	TW	\$574.51	(This includes a section of divided roadway)—In-
					cludes \$526.96 for seal coat application
			SH	366.47	Includes \$230.21 for remixing and sealing shoulders
			RS	65.18	
			S	89.12	
			SD	266.85	Includes \$150.50 for traffic stripe and renewal and
					[\$69.81 for metal guard rail
Symbols TW—Traveled Way, SH—Shoulders, RS—Road side, S—Structures, SD—Safety Devices, T—Trees, D—Drifts, M—Misc.			T	302.37	This includes upkeep on trees between the divided
			D	6.83	Account of drifting sand [roadways and two
			M	10.29	[rows of shrubbery
			Total	\$1,681.62	

quate structures can not be reduced materially by replacement in any one year. It is essential therefore, that whatever funds are required to keep the bridges in safe condition be made available as soon as a need develops. The trend in this regard is shown in Table 7, with 41.3 per cent of the six-year expenditure applied in the last two years.

The steady increase in expenditures for safety devices is shown in Table 7, with a variation of from 13.2 per cent in 1934 to 21.07 per cent in 1939. This item includes cost of placing traffic stripes, as well as operating illuminated signs, traffic signals and highway lighting. If present demands are an indication, the amount required will continue to increase each year.



Slide on Ridge Route, Los Angeles County, in 1938 storm.



Large slide on Coast Route, north of Santa Monica, Los Angeles County.

There are some 850 miles of road on which trees have been planted by the State. In addition, there are many plantings at subways and entrances to towns.

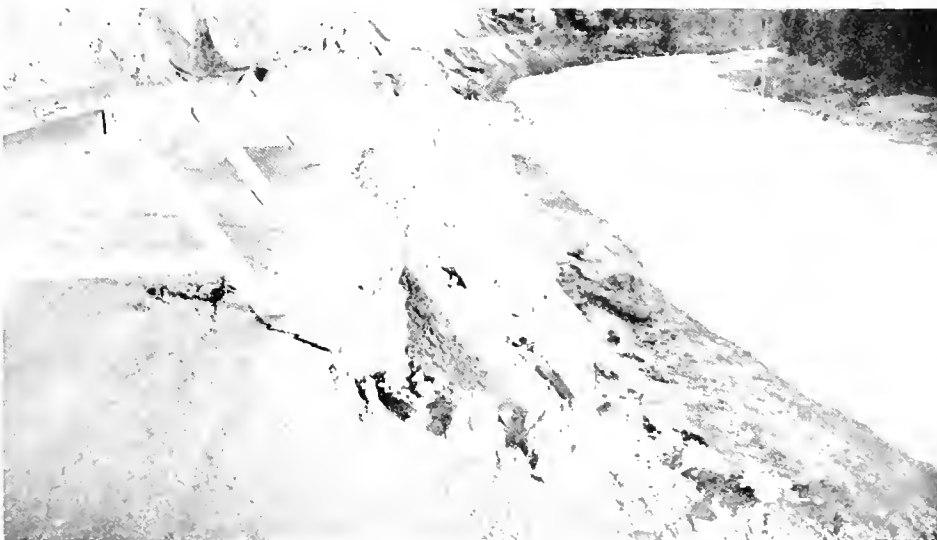
The marked increase in the cost of "tree" maintenance is primarily due to improvement work undertaken at the insistence of the Federal Government. One per cent of Federal funds must be applied to roadside beautification under existing regulations.

As the annual cost of upkeep is frequently equal to the original cost on certain types of planting, maintenance expenditures have increased unduly. If the investment is to be preserved, there is little prospect that this item can be reduced.

The cost of snow removal and sanding icy pavement is a major item in

the "Drift" classification. The cost of this work varies from year to year with the severity of the particular season. It is essential, if the work is to be successful, that a complete organization be ready and equipped to start work at any time after the first heavy snowfall. There is little indication in advance as to the severity of a season. The expense of preparation is the same, therefore, every year, and the expense of stand-by service is considerable, even in a mild season.

In reviewing the record of expenditures for the year ended June 30, 1939, it is found that the average cost per mile for maintenance in thirty-seven counties of the State with San Francisco city and county excluded, was less than the average rate of \$700 per mile. In the other twenty coun-



Flood damage on Redding-Alturas Highway, Shasta County in 1937 storm.

ties, the average cost exceeded that amount. As an indication of the amounts and reason for such heavy expense, there is listed in Table 8 a few sections showing the occasion for the work, as well as per mile cost for the various classes of work.

In summarizing the discussion by class of expenditures, it is to be noted that the upkeep expense for the most essential features—the traveled way, shoulders and structures—represents nearly 52 per cent of total maintenance cost. The roadside item, which, insofar as slide removal and restoration is concerned, is equally essential, represents 33 per cent of expenditures. The cost for safety devices, trees and drifts is 12 per cent of the total.

Expenditures may also be analyzed from an entirely different point of view. Expenditures for salaries and wages for the year ended June 30, 1939, were 44.53 per cent of the total on the rural State highways.

The balance of the expenditure was made up as follows:

Materials and Supplies_	21.44%
Service and Expense----	6.12%
Equipment Rental-----	17.39%

All the charges for these things were directly applicable to specific sections of the highway. In addition, 10.52 per cent of the total expense was of a general nature and not susceptible to direct allocation to the foregoing items.

Total expenditures for direct labor amounted to \$3,837,719.46. It is estimated that during the current year, this amount may be increased by approximately \$375,000 due to increases in salaries. This is a matter over which the Division exercises only nominal control, since the statutes provide, when an employee's efficiency rating amounts to 80 per cent, for an automatic increase in salary up to a set maximum. Since, from February 1932 to April 1937, no increases in salaries were given within any grades, and since appointments were made at the minimum salaries, it follows that a large percentage of the employees are eligible for increases in salary. Had salaries been increased in the normal manner during that period, the change of trend that will develop in labor cost would have been less marked.

It may be noted in passing that the above distribution of expenditures in California is in line with those gen-

Channelizing Traffic in Oakland

(Continued from page 13)

lined. A study was made of the manner in which the traffic used the traffic lanes. From this study, a few minor modifications were made in the design before it was constructed.

SPEED OF VEHICLES CONTROLLED

Some cities have outlined the design on the pavement with timber bulkheads, tie curbs, and sand bags painted white as an experiment in channelizing an intersection. These methods are effective but often create a hazard because of their temporary nature, with the added necessity of proper illumination at night.

Two reasons are paramount in the causes of accidents; namely, speed and disregard of the rules of the road; i.e., traffic laws.

By channelizing traffic into well-defined lanes, it becomes imperative for traffic to slow down to enter the traffic lanes, so speed is controlled. Since all traffic in a channelized intersection must use the same lane or parallel lane when going in one direction, the whims of the "roadhog" are in a measure controlled.

INTERESTING STATISTICS

The Safety and Traffic Engineering Department of the American Automobile Association has given a great amount of thought and study to the safety of traffic and many interesting facts have been disclosed. It was found that in a 7-year trend of traffic fatalities, in 30 cities, nonpedestrian deaths had been reduced 30 per cent while pedestrian fatalities had increased 40 per cent. It was also found that two out of three pedestrians killed were over 40 years of age, less than 1/10 are children under 15 years, and only 1/5 are between 15 and 40 years of age.

eral throughout the United States. The report to the Highway Research Board already referred to states: "Maintenance expenditures are made in reasonably fixed proportions: Direct labor 43 to 52 per cent of total expenditures; materials 17 to 28 per cent; equipment 20 to 31 per cent; and overhead 5 to 11 per cent."

The third installment of Mr. Dennis' address will appear in the March issue of California Highways and Public Works.—Editor.

In another investigation, it was found that unfamiliarity with problems of motor vehicle operation plays an important part in pedestrian fatalities. Connecticut studied 1,031 deaths to pedestrians over 15 and found that 95 per cent had never been licensed to drive. Who, of the drivers of motor vehicles, has not been startled at night by a pedestrian appearing suddenly in view, walking leisurely? These pedestrians apparently do not realize that unless they are in direct line of the beams of light, the driver of the car is invariably unaware of his presence on the roadway.

These investigations disclosed that 75 per cent of the pedestrian fatalities occurred after sunset. An elderly pedestrian walking at the rate of about 2 miles per hour will require half a minute to cross an intersection having a roadway width of 90 feet between sidewalks. An automobile traveling at the rate of 25 miles per hour will traverse 1,100 feet in the same length of time. The lack of appreciation of the time and speed of the automobile and often the lack of the driver's consideration of the pedestrian's problems have led to many accidents.

By channelizing vehicular traffic, the width of roadway has in all cases been reduced to a one-way street. This permits the installation of safety zones for pedestrian traffic. In all cases, accidents to both vehicular and pedestrian traffic have been greatly reduced by channelization.

A collision diagram submitted by the City of Oakland on two of the intersections fully substantiated this statement. At East 18th Street and Lakeshore Avenue in 1937, before channelization, there were 10 accidents with a daily vehicular traffic through the intersection of approximately 14,000 vehicles. In 1938, the channelization was made. During all of 1939, there was only one accident in the new channelized intersection. This accident was due to a deliberate violation of right-of-way rules on the part of one of the drivers. While no traffic count has been made since the intersection was channelized, it is known that vehicular traffic has increased considerably.

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New highway in Santa Ana Canyon graded for ultimate 4-lane divided highway section with surfacing for two lanes completed. Oil-mix berms on right prevent slope erosion.

Relocation in Santa Ana Canyon

By A. EVERETT SMITH, Assistant Highway Engineer

THE "Mountains to the Sea" route provides the residents of Riverside and San Bernardino counties their most accessible route to the coast where many go to enjoy the recreations of the beach areas. This same route also provides the populous harbor and beach areas of Los Angeles and Orange counties their most direct road to the various resorts located in the mountains of Riverside and San Bernardino counties.

This route is State Sign Route No. 18 which passes through the cities of Riverside, Corona and Santa Ana and through the Santa Ana Canyon, entering the canyon proper west of Corona. The highway at this location is known as the "Santa Ana Canyon Highway."

Construction on new alignment of that portion of the highway extending westerly from Corona to the Riverside-Orange County line on the south side of the canyon was completed December 8, 1939. The re-

alignment was made necessary by the construction of the Prado Dam across the Santa Ana River for flood control in Orange County.

The dam, now being constructed for the impounding of flood waters, has caused the debilitation of the area within the confines of the ultimate high water contour line and involved the removal of many buildings and facilities. A portion of the Santa Fe Railway and the Santa Ana Canyon Highway were under the ultimate high water elevation. This necessarily involved the relocation of the railway and the highway facilities.

Reconstruction of this portion of highway had been under consideration for some time, but could not be undertaken until the location of the dam was determined.

When the dam location was definitely fixed by the U. S. Engineers, a survey was made and plans drafted for the new highway. The new high-

way location extends in an almost direct line from Corona to an intersection with the existing highway at the Orange County line, whereas the old road angled from Corona northwesterly to Prado and continued down along the south side of the Santa Ana River.

It was through this section along the river that considerable damage was experienced during the flood of March, 1938. The new location is a distinct advantage over the old road. It is high above the river, it reduces the length by about one mile and eliminates many sharp and dangerous curves. It is south of the old road and skirts the mountains rising from the river channel.

For building this new highway link, a contract was first awarded by the Orange County Flood Control District to Person & Hollingsworth and Wilbur C. Cole for the construction of approximately 1.5 miles op-

(Continued on page 28)



Relocation of the Santa Ana Canyon Highway necessitated by construction of Prado Dam across the Santa Ana River for flood control in Orange County between Corona and the Orange County line, takes the highway and Santa Fe Railroad, both of which were flooded in 1938, high above the river. In addition the more direct route shortens the distance about a mile and eliminates many sharp and dangerous curves.

Construction Progress and Pavement Records for 1939

Publication of the following annual report by the Construction Department of the Division of Highways, giving details of pavement construction during the past year, is eagerly awaited both by contractors and State engineers connected with the various projects, who evince a keen competitive interest in the records of average daily concrete yardage, strength per square inch, per cent variation in cement control, asphalt tonnage, etc., and roughness index per mile.

By EARL WITHYCOMBE, Assistant Construction Engineer

PRESENT policy dictates that intensive investigational work be conducted on all projects during the planning stage to note and study the subsurface conditions that might affect the stability of the roadway. The character of the soil, the presence of underground water and any weakness in the geological structure are carefully investigated. Expenditures for such work range from \$75 per mile to as high as \$1,000 per mile on heavy highway construction. The greater part of this expenditure is invested in borings taken with drill rigs constructed especially for this purpose, and with the information furnished by these borings, a fairly accurate record can be obtained of the efficiency with which nature has laid down the foundation upon which the roadway is to be constructed.

The actual cash value of the returns paid by such investigational work is a very intangible figure, but the fact that it does pay dividends can not be denied. In work constructed in recent years, the frequency of major slides, slipouts, and settlements, with their annoying interruption to traffic, has been materially reduced. That overdesign sometimes results from the effort to avoid any chance of failure where indications given by the investigations are unfavorable, can not be denied, and special effort is necessary to guard against excesses; however, the added factor of safety in such instances is often a very desirable quality.

The greater part of the investigational work is carried on by the various districts with their own laboratory forces, but when large diameter borings become necessary,

the Headquarters Laboratory is called into conference, and they furnish the equipment and personnel required to conduct such work.

For the newly constructed roadway blankets are provided wherever possible with the most suitable local material selected for the purpose, and in some instances, blanketing material has been imported from a considerable distance. This strengthening of the immediate foundation for the road surface has resulted in a more or less revolutionary revision of ideas of the requirements for a satisfactory pavement surface. Such bases have eliminated the necessity of the so-called high-type pavement in a great many cases, permitting the use of intermediate types, or have made it possible to materially reduce the pavement thickness. As a consequence, construction costs have been materially decreased and more miles of improved highway have been constructed with the funds available. A concrete example of this tendency is indicated in the comparison of mileages constructed during the past two years. The combined mileage of the permanent or high-types constructed in 1939 is but 17 per cent of that constructed in 1938.

The life of the intermediate types is not expected to be comparable with that of the higher-type pavement, but their service life will be such that they will pay for themselves in returned income, and when permanent pavement becomes necessary, they will provide an ideal base upon which to construct same. By such procedure weakness that may exist in the pavement foundation will be disclosed and will be corrected before the permanent pavement is placed.

PORTLAND CEMENT CONCRETE

Construction Methods

Surface smoothness has been materially improved by the use of the Johnson drag finisher, a development made by one of the assistant engineers in the Construction Department, who has been connected with this type of work for a long period of time. The drag finisher type of manipulation was made optional in competition with standard methods and has met with such enthusiastic reception by contractors that it was used exclusively during the past season. This method has spread to adjoining states, and results have been very gratifying.

Another device developed by a construction employee, known as the Wilzek volumeter, was used to advantage on some of this season's projects to measure the pay quantity of concrete pavement. This device is a volume integrator of the subgrade section and provides a speedy and more accurate means of measurement of pay quantity than former methods. This device has been given recognition by engineering publications.

Approximately 60 per cent of the 1939 concrete pavement was Class "A" concrete with six sacks of cement per cubic yard, the remainder consisting of Class "B" with five sacks of cement per cubic yard.

Automatic scales were used to proportion the aggregates on all major projects, and these scales have been developed to the extent that little difficulty is experienced in their operation. Very little cement was proportioned in with the aggregate and in



Twenty-two foot portland cement concrete pavement between Gaviota Pass and Santa Ynez River on State Highway Route 2 in Santa Barbara County. The record for cement control was made on this contract, the average variation being only 0.28 per cent. The average variation on State contracts during the year 1939 was 0.58 per cent.

nearly every project, cement was delivered to the grade in cloth bags and dumped by hand into the mixer skip.

With the adoption of the Johnson drag finisher, the operation of placing concrete has been greatly simplified. The equipment now consists of one mechanical tamper and finisher, providing it is a modern machine; otherwise, two are required, with one Johnson drag finisher and one cut float. Very little remains to be done with the cut float behind the drag finisher, but it does help to give a more granular surface texture and removes any slight irregularities that may remain after the drag finisher has finished.

Construction Records

The maximum *average daily output* for portland cement concrete pavement per 8-hour day was on Contract 07XC20, Road VII-LA-79-A, at San Martinez Chiquito Canyon, Matieh Brothers, Contractor, 450.0 cubic yards being placed per day. F. A. Read was the resident engineer, with H. J. Johnson as street assistant. The average daily output for the State was 381 cubic yards during the year 1939, as compared to 408 cubic yards in 1938.

The *average compressive strength* at 28 days for Class "A" concrete pavement was 5170 pounds per square inch in 1939, compared to 4760 pounds in 1938; while for Class "B" concrete pavement, an average strength of 3740 pounds was obtained in 1939, as against 3890 pounds in 1938.

During 1939, the highest average compressive strength for Class "A" concrete pavement was 5694 pounds, also being on Contract 07XC20, Road VII-LA-79-A, referred to above. The strongest Class "B" concrete pavement averaged 3815 pounds, on Contract 08XC3, Road VIII-SBd-26-E, Santa Ana River Bridge approaches, Basich Bros., Contractors; G. E. Malkson, resident engineer; and H. Bridgeman, assistant.

The record for *cement control* was made on Contract 05VC2-65VC13, Road V-SB-2-D, Gaviota Pass to Santa Ynez River, the average variation being but 0.28 per cent. Sparks & Mundo were the contractors; J. C. Adams, resident engineer; and S. N. Isham, assistant. The average variation for the State during 1939 was 0.58 per cent, as compared to 0.72 per cent in 1938.



Six-lane free-way with 11-foot asphalt concrete, portland cement concrete, and plant-mix pavement strips on Arroyo Seco Parkway between Los Angeles and Pasadena.

The record for *surface smoothness* was made on Contract 04TC7-84TC16, Road IV-Ala-5-D, Castro Valley Junction to San Leandro, with an average roughness per mile of 4.8 inches. Jones & King were the contractors; F. W. Montell, resident engineer; and H. H. Deardorff, assistant. The average smoothness for the State in 1939 was 5.8 inches per mile as compared to 7.8 inches for 1938, a 26 per cent improvement in riding surface.

ASPHALT CONCRETE

Construction Methods

The operation of mixing plants has not changed much in the past few years. Automatic scales for the proportioning of aggregate were used on all major projects during 1939.

The use of higher-penetration asphalts has become standard practice, and a considerable amount was

used in the past season's work. There are three penetration ranges permissible, 71 to 85, 86 to 100, and 101 to 120, the grade to be designated by the engineer to suit conditions for the particular project.

Sand gradings for asphalt concrete have been materially revised, permitting a much coarser sand to be used, and the amount of filler dust has been reduced. These changes have produced a mixture that is easier to handle and is less critical to fluctua-

PORTLAND CEMENT CONCRETE PAVEMENT RECORDS FOR 1939

Location	Contractor	Resident Engineer	Street Assistant	Average cu. yds. laid per 8-hour day	Average strength, 28 days, lbs. per sq. inch	Per cent average daily variation in cement	Roughness index, inches per mile
Castro Valley Junction—San Leandro	Jones & King	F. W. Montell	H. H. Deardorff	427.0	3620	0.82	4.8
Gaviota Pass—Santa Ynez River	C. O. Sparks & Mundo Eng'g. Co.	J. C. Adams	S. N. Isham	350.0	4822	.28	5.8
Tunnel Sta.—Placerita Canyon	Griffith Company	E. L. Seitz	J. Fleharty	423.9	5269	.47	5.8
Hough Street—Meridian Ave.	Claude Fisher Co.	R. J. Hatfield	A. W. Carr	433.4	5042	.50	4.9
Sulphur Slide—Riverside County Line	V. R. Dennis Co.	F. B. Cressy	H. D. Johnson	215.0	5527	1.00	8.6
Santiago Blvd.—Santa Ana Canyon Rd.	United Concrete Pipe Corp.	H. B. Lindley	H. D. Johnson	359.0	4510	.71	6.1
At San Martinez Chiquito Canyon	Matich Bros.	F. A. Read	H. D. Johnson	450.0	5694	.72	7.2
Santa Ana River Bridge approaches	Basich Bros.	G. E. Malkson	H. Bridgeman	97.1	3815	1.92	5.4
La Mesa—Grossmont	Griffith Company	L. H. Williams	E. C. Dodson	309.0	3562	.50	8.2
Averages				381.0	5170(A) 3740(B)	0.58	5.8

tions in the amount of asphalt used. A seal coat has been provided for asphalt concrete using not to exceed one-tenth gallon of emulsified asphalt per square yard of surface and without a cover coat. Where the surface is somewhat closed, the emulsion is diluted before application with equal parts of water. Traffic can be carried over this seal coat without inconvenience. The amount of actual asphalt is just sufficient to coat the bottom of the surface interstices which are inaccessible to the roller and without leaving an appreciable amount on the surface that is in contact with the tires. No raveling of the surface is experienced with work carried on even in the coldest weather, since this seal coat has been adopted, and the surface is apparently sealed off from any infiltration of water. Asphalt surfaces with this seal coat have functioned remarkably well over a period of five years.

The efficiency of spreading and finishing machines has been materially increased, and machines that are now manufactured in California especially for this purpose are far superior to any on the market.

Rolling and compacting of mixtures follow previous practice. The use of the three-axle roller has reduced the amount of equipment required where large output is produced. The method of cross-rolling to remove irregularities as a final operation is necessary behind any equipment so far used. The Seitz bump-marker, a development by one of the construction personnel, is in general use to rapidly mark surface irregularities on which to concentrate

the cross-rolling. This equipment has been in demand throughout the western states.

The average roughness for the 1939 season exceeds that of 1938 by 3.5 inches per mile, largely because of the limited length of each project constructed in 1939, the average length being but 23 per cent of that of the 1938 projects.

Construction Records

The highest *average daily output* of asphalt pavement tonnage was placed on Contract 04TC7-84TC16, Road IV-Ala-5-D, between Castro Valley Junction and San Leandro, where 684 tons were placed by Jones & King, Contractor; F. W. Montell was the resident engineer, with E. E. Watkins, street assistant.

The average daily output for the State was 561.8 tons in 1939, as compared to 660 tons in 1938.

The highest *stability of surface mixtures* was obtained also on Contract 04TC7-84TC16, with an average of 48.2 per cent. The average stability for the State was 32.4 per cent for 1939, compared to 35.4 per cent in 1938.

The *densest surface mixture* was placed on Contract 011VC3, Road XI-Riv-26-Ind.F, between west city limits of Idaho and Route 64, where the average relative specific gravity was 96.0 per cent. R. E. Hazard & Sons were the contractors; R. C. Payne, resident engineer; and M. C. Barron, street assistant. The average for the State in 1939 was 93.8 per cent, compared to 93.5 per cent in 1938.

The record for *surface smoothness*

was secured on Contract 04TC7-84TC16, Road IV-Ala-5-D, between Castro Valley Junction and San Leandro, where the average was 9.7 inches per mile. The contractor was Jones & King, with F. W. Montell as resident engineer, and E. E. Watkins, street assistant. The average for the State in 1939 was 18.8 inches per mile, compared to 15.3 miles in 1938.

BITUMINOUS TREATED SURFACES

The road-mix type leads the plant-mix slightly during 1939, about 260 miles of the two types being constructed during the year. A considerable part of this mileage was constructed on roads of major importance.

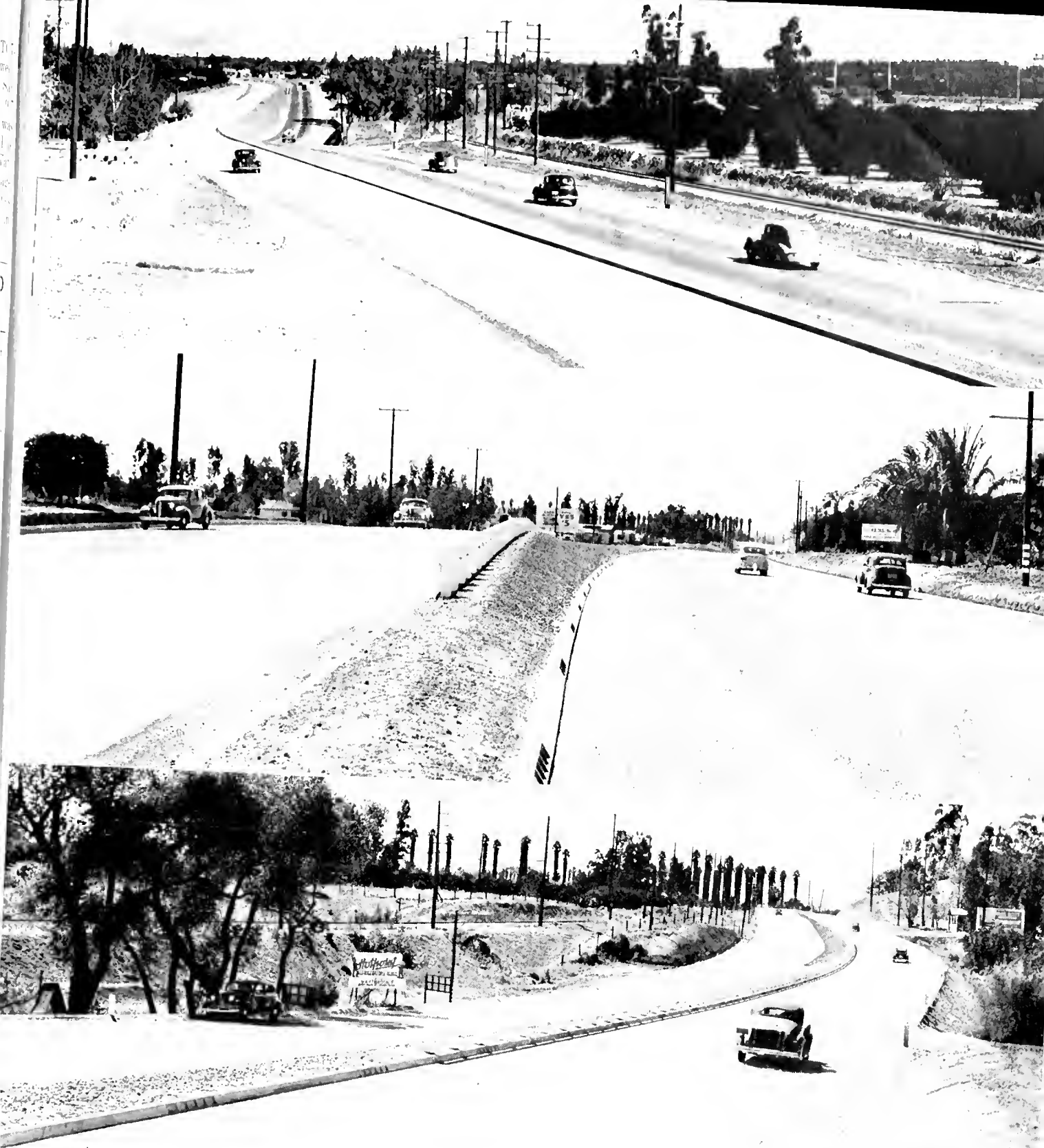
Road-mix construction was largely accomplished by traveling mixers. A method of readily determining the amount of oil necessary with an aggregate by coating the same with a solvent, was experimented with by Resident Engineer C. V. Kane and worked out satisfactorily for the aggregate with which they were using. The Laboratory is now working out a technique to make the method applicable to any aggregate, and it is expected that the equipment will be available for next season's work. By this means, fluctuations in the oil demand may be readily discovered in the field, and the necessary corrections made without delay.

Approximately the same mileage of armor coat was constructed in 1939

(Continued on page 28)

ASPHALT CONCRETE PAVEMENT RECORDS FOR 1939

Location	Contractor	Resident Engineer	Street Assistant	Average tonnage laid per day	Average stability of surface mixture in per cent	Average relative gravity of surface mixture in per cent	Roughness index, inches per mile
Gastro Valley Junction—San Leandro	Jones & King	F. W. Montell	E. E. Watkins	684.0	48.2	93.0	9.7
N. Main St.—Mission Road on Daly and Mar- engo Sts.	J. E. Haddock	C. P. Montgomery	A. L. Hawkins	523.0	36.0	92.3	17.3
Filmer—Hopper Creek	Macco Construction Co.	W. I. Templeton	W. A. Norman	594.0	22.0	94.5	24.0
Hough Street—Meridian Ave.	Claude Fisher Co.	R. J. Hatfield	A. W. Carr	430.0	36.9	92.0	10.8
Rivera Underpass—Shenandoah Ave.	W. E. Hall Co.	W. D. Eaton	G. H. Lamb	292.0	38.0	93.1	17.5
Lomita Blvd. to Wilmington—San Pedro Rd.	Griffith Company	C. N. Ainley	A. W. Carr	428.3	42.5	90.8	10.6
Glassell Ave., Fairhaven Ave.—S. City limits	Sully-Miller Co.	A. L. Hawkins	G. H. Lamb	449.1	34.0	90.3	19.3
Anaheim—Telegraph Rd. to Rivera	J. E. Haddock	W. D. Eaton	H. D. Johnson	248.0	16.0	95.6	30.6
Ocean Ave., Colorado Ave.—Pico Blvd.	Oswald Bros.	H. J. Fallai	A. W. Carr	551.0	36.0	91.9	41.7
W. City Limits, Indio—Route 64	R. E. Hazard & Sons	R. C. Payne	M. C. Barron	635.0	24.1	96.0	22.7
Averages				561.8	32.4	93.8	18.8



Divided highway with two 23-foot road-mix surfaced lanes between Colton and Riverside on Route 43 in Riverside and San Bernardino Counties.

BITUMINOUS TREATED SURFACES: RECORDS FOR 1939

Plant Mix

Location	Contractor	Resident Engineer	Roughness Index Inches per mile
4 mi. S. of Fagan—Biggs Rd.	Piazza & Huntley	J. C. Womack	18.9
0.3 mi. N. of Sonoma Co. Line—Squaw Creek	Hanrahan Company	C. M. Butts	28.2
Hirschdale—Nevada State Line	Union Paving Co.	J. W. Corvin	37.1
At Colfax grade separation	Piazza & Huntley	H. O. Ragan	16.1
Colfax Overhead Crossing—0.6 mi. N.	A. Teichert & Son	H. O. Ragan	20.1
Kiesel—Sacramento Weir	J. R. Reeves	W. G. Remington	33.2
1.5 mi.—3.9 mi. southwest of Sebastopol	Embleton-Schumacher	E. Carlstad	23.9
Muir—Willow Pass	Macco Construction Co.	C. F. Price	23.0
Var. points Napa and Sonoma Counties	A. G. Raisch	C. F. Price	64.0
At Napa State Hospital	A. G. Raisch	E. Carlstad	36.2
San Lucas—1.3 mi. southerly	Granite Construction Co.	V. E. Pearson	21.7
1st-2d Crossing Cuyana River, Lompoc—La Salle Rd.	Basich Bros.	J. C. Adams	21.9
Las Cruces—S. Inez River and Orcutt—Guadalupe	Basich Bros.	J. C. Adams	21.7
Kingsburg—Fresno	L. A. Brisco	F. W. Howard	16.3
Tunnel Sta.—Placerita Canyon	Griffith Co.	E. L. Seitz	20.5
Near Galivan	B. G. Carroll	C. L. Gildersleeve	20.3
At Pacific Colony Hospital (Spadra)	Griffith Co.	H. J. Fallai	16.2
Filmer—Hopper Creek	Macco Const. Co.	W. I. Templeton	13.9
1.5 mi. N. of Azusa—San Gabriel River Bridge	Lewis Construction Co.	W. J. Calvin	54.4
At San Martinez Chiquito Canyon	Matich Bros.	F. A. Read	29.3
2 mi. W. of Los Angeles Co. Line	S. Edmundson & Sons	W. E. Melcher	50.3
Lomita Blvd.—Wilmington—San Pedro Rd.	Griffith Company	C. N. Ainley	10.6
Orange Co. Line—Corona	V. R. Dennis Const. Co.	J. M. Hollister	13.3
Devore—Cajon	W. E. Hall Co.	E. A. Bannister	17.1
San Bernardino—Santa Ana River	V. R. Dennis Const. Co.	G. E. Malkson	6.5
Upland—Haven Ave., SBd.—Verdemont	Oswald Bros.	R. A. Bergman	6.6
Briceburg—El Portal	Griffith Co.	A. N. Lund	16.8
0.6 mi. S.—1.0 mi. N. of Vallejo	A. G. Raisch	G. R. Hubbard	20.4
La Mesa—Grossmont	Griffith Co.	L. H. Williams	24.4
Hough Street—Meridian Ave.	Claude Fisher Co.	R. J. Hatfield	23.3
Las Cruces—Atascadero	Basich Bros.	J. C. Adams	21.3
Buckhorn School—1 mi. SE. of Piru	J. E. Haddock	E. L. Seitz	7.4
Average			26.2

Road Mix

Big Lagoon—1 mi. N. of Orick	Claude C. Wood	C. A. Shervington	28.8
Benbow's—1 mi. N. of Dean Creek	Poulos & McEwen	C. A. Shervington	38.0
5½ mi. E. of Rte. 1, and 1.7 mi.—23 mi. E. of Lucerne (por.)	Lee J. Immel	C. M. Butts	35.8
In Fort Bragg—certain streets	Helwig Construction Co.	A. Wallace	27.4
Madeline—Likely	Poulos & McEwen	C. A. Potter	38.5
2 mi. W. of Rte. 83—Chester	Garcia Construction Company	A. A. Bigelow	29.6
Callahan—Fort Jones	Garcia Construction Company	G. Sundman	37.0
Big Bar—Junction City	Young & Son	G. Sundman	18.4
Shingletown—2.9 mi. easterly	Claude C. Wood	G. Sundman	22.0
At Central Valley, 6.5 mi. N. of Redding	Granfield, Farrar & Carlin	H. B. Milner	17.7
Termo—Northerly boundary	Poulos & McEwen	C. A. Potter	43.5
Inspiration Point—Los Gatos	Heafey-Moore Co. & Frederickson & Watson Co.	A. Walsh	33.3
½ mi. S. of Davenport—Waddell Creek	N. M. Ball Sons	H. A. Simard	11.9
3.5 mi. E. of Bell's Sta.—Mer. Co. Line	Lee J. Immel	H. S. Payson	40.2
Visalia Airport—4 mi. S. of Dinuba	Union Paving Co.	P. B. Stearns	51.8
San Joaquin River—Kelshaw Corner	Ruddy & Corfield	F. W. Howard	39.1
1.2 mi. N. of La Canada—Mt. Wilson Rd.	R. M. Price	W. E. Melcher	35.7
0.1 mi. S. of SBd. Co. Line—Colton	Matich Bros.	G. E. Malkson	12.4
Barstow—1 mile northerly	A. S. Vinnell Co.	R. A. Bergman	25.4
Big Bear Dam—Meadow Lane	R. E. Hazard & Sons	R. A. Bergman	9.5
Sonora Junction—Coleville (por.)	A. S. Vinnell Co.	H. F. Caton	8.2
4 mi. E.—12 mi. E. of Mojave	J. A. Casson	C. M. Rose	15.9
Death Valley National Mon.—Death Valley Junction	Oswald Bros.	J. N. Stanley	53.6
Benton Station—Nevada State Line	J. A. Casson	F. R. Pracht	17.4
9.6 mi.—10.7 mi. SE. of Keeler	Anderson & France	F. R. Pracht	38.1
Boulder Park—Mountain Springs	A. S. Vinnell Co.	R. C. Payne	28.6
Near Thermal	Basich Bros.	C. R. Hagberg	6.3
Through La Jolla Indian Reservation	R. E. Hazard & Sons	R. C. Payne	16.0
Average			31.9

Armor Coat

½ mi. W. of Snodgrass Slough—Glennvale	Hemstreet & Bell	W. W. Greer	54.2
Davis Wye—Willow Slough, Cache Creek—2.2 mi. N.	E. A. Forde	H. F. Sherwood	62.3
Bryte—Broderick, Lincoln Way—Auburn Blvd.	J. R. Reeves	W. G. Remington	36.3
1 mi. E. of Bell's Sta.—3 mi. W. of Merced Co. Line	Granfield, Farrar & Carlin	H. S. Payson	28.1
Northwood Park—Guerneville	Heafey-Moore Co. & Frederickson & Watson Co.	W. A. Rice	62.3
1.2 mi.—8.2 mi. E. of Mission San Jose	Jones & King	F. W. Montell	85.5
Woodwardia—Hall's Bridge	Eaton & Smith	A. L. Lamb	51.2
Average			53.3

Highway Bids and Awards Jan., 1940

Channelizing Traffic in Oakland

(Continued from page 18)

At El Embarcadero during 1938, there were 12 accidents reported, two in which pedestrians were involved. This intersection was channelized during the first 6 months of 1939. During the construction period, 3 accidents occurred. During the last 6 months, 2 accidents occurred, one due to a defective wind shield and one due to following too closely. One accident occurred when a parked car turned into the line of traffic, which is not considered attributable to intersection restrictions. A traffic census of this intersection taken in January, 1937, showed a daily average for a 24-hour period of over 22,000 vehicles through El Embarcadero. In addition, 9,000 vehicles used Grand Avenue, north and south, and 3,000 used Lakeshore Avenue, north and south.

While it is not claimed that channelization is the complete solution of intersection problems, the experiment so far indicates that many of the causes of accidents have been eliminated and that accidents have been reduced.

Some motorists complain of their inability to determine the correct traffic lane to use when approaching a channelized intersection. It is felt, however, that this confusion is more psychological than real because experience has shown that as motorists become familiar with these intersections, no more complaints are received and numbers of accidents are greatly reduced.

HIGHWAYS IMPROVED AS TRAFFIC MOVES

The way the State improves highways today with no inconvenience or delay to traffic is illustrated in a 2.3 miles grading and plant-mix surfacing job being done on U. S. Highway 101 between a point east of El Capitan Creek and Orella in Santa Barbara County.

Sophomore—"Were you ever bothered with athlete's foot?"

Freshman—"Yes, once when the captain of the football team caught me with his girl.—Hudson Star.

ing over the Southern Pacific Co. tracks at Weed consisting of two 62.54-foot and one 98-foot steel girder spans on steel columns with reinforcing concrete footings and abutments. District II, Route 72, Section A, John Rocca, San Rafael, \$51,125; M. A. Jenkins, Sacramento, \$52,670; D. W. Nicholson, Oakland, \$53,892; Albert H. Siemer and John Carcano, San Anselmo, \$55,920; Clifford A. Dunn, Klamath Falls, Oregon, \$56,248; R. M. Price, Huntington Park, \$56,420; Robert McCarthy, San Francisco, \$57,610; A. Soda and Son, Oakland, \$58,534; Scheumann and Johnson, Eureka, \$64,080. Contract awarded to F. Fredenburg, So. San Francisco, \$48,865.

SONOMA COUNTY—A reinforced concrete bridge across Tolay Creek about 19 miles southwest of Napa. District IV, Route 8, Section A, Harold Smith, St. Helena, \$6,844; Robert McCarthy, San Francisco, \$7,888; John Carcano, San Rafael, \$8,033; C. C. Gilderleeve, Berkeley, \$8,160; A. Soda and Sons, Oakland, \$8,256; Utah Construction Co., San Francisco, \$8,375; Stanley P. Cooley, Palo Alto, \$8,444. Contract awarded to F. Fredenburg, So. San Francisco, \$6,242.

TULARE COUNTY—Between Kingsburg and 1.9 miles southerly about 1.7 miles to be graded and surfaced with asphalt concrete and plant-mixed surfacing. District VI, Route 4, Section E, M. J. B. Construction Co., Stockton, \$88,205; A. Teichert & Son, Inc., Sacramento, \$97,277; Marshall S. Hanrahan, Merced, \$98,810; A. Soda and Son, Oakland, \$107,482. Contract awarded to Piazza & Huntley, San Jose, \$77,614.

TULARE COUNTY—Between Thermal School and Ducor, about 3.1 miles to be graded, penetration oil treatment applied thereto and a reinforced concrete bridge to be constructed. District VI, Route 129, Section A, Claude C. Wood, Lodi, \$38,627; Fredrickson Bros., Emeryville, \$40,373; A. Teichert & Son, Inc., Sacramento, \$41,709; Anderson & France & Knapp, Visalia, \$42,844; Rexroth and Rexroth, Bakersfield, \$44,222; A. S. Vinnell Co., Alhambra, \$45,587; R. E. Hazard & Sons, San Diego, \$45,679; Griffith Co., Los Angeles, \$46,714; The Utah Construction Co., San Francisco, \$48,681; Valley Construction Co., San Jose, \$51,581; Basich Bros., Torrance, \$53,067; G. W. Ellis, North Hollywood, \$53,999; J. W. & E. M. Breedlove, Alhambra, \$55,983. Contract awarded to Louis Biasotti & Son, Stockton, \$36,712.90.

YOLO COUNTY—Causeway across Yolo By-Pass about 5 miles west of Sacramento, a portion to be relocked. District III, Route 6, Sections A & B, M. J. B. Construction Co., Stockton, \$61,138; John Rocca, San Rafael, \$66,412; D. W. Nicholson, Oakland, \$76,554; A. Teichert & Son, Inc., Sacramento, \$76,745; Engineers, Limited, San Francisco, \$78,985. Contract awarded to Lee J. Humel, Berkeley, \$59,272.

Plaint of Auto Makers

Tax collectors took more money from motorists in special fees and taxes in 1938 than motor vehicle manufacturers received that year for new cars and trucks sold in the United States. Wholesale value of the vehicles, according to the Automobile Manufacturers Association, was \$1,400,000,000, whereas special fees and taxes paid by motor vehicle owners exceeded \$1,500,000,000.

State highway grading work is in progress over five miles between La Jolla Indian Reservation and Morettis in San Diego County.

DEL NORTE COUNTY—Across Smith River about 9½ miles north of Crescent City, a combination steel girder and reinforced concrete bridge to be constructed and about 0.3 mile of approaches to be graded and a bituminous seal coat applied. District I, Route 71, Section A, Hanrahan Connolly Co., San Francisco, \$246,830; John Rocca, San Rafael, \$256,222; A. Soda and Son, Oakland, \$266,769; C. W. Caletti & Co., San Rafael, \$274,978; R. G. Clifford, San Francisco, \$279,063; E. E. Smith, Eureka, \$279,700; United Concrete Pipe Co. & Mercer-Fraser Co., Eureka, \$291,885. Contract awarded to Joseph Shaw, Oakland, \$246,028.

IMPERIAL COUNTY—Construct portland cement concrete bridge and remove existing bridge at Central Main Canal, one and one-half miles west of El Centro. District XI, Route 12, Section C, Thomas Construction Co., Burbank, \$10,628; Tayares Construction Co., Los Angeles, \$12,500; Chas. W. Pettifer, Long Beach, \$20,911; Valley Construction Co., San Jose, \$11,818; Walter H. Barber, San Diego, \$12,697. Contract awarded to B. G. Carroll and Harry L. Foster, San Diego, \$9,965.

MONTEREY COUNTY—Between 2 miles south and 3 miles north of Greenfield, about 5.6 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District V, Route 2, Sections E.D. Fredrickson Bros., Emeryville, \$112,516; Piazza & Huntley, San Jose, \$115,983; G. W. Ellis, North Hollywood, \$118,844; M. J. B. Construction Co., Stockton, \$120,717; A. Teichert & Son, Inc., Sacramento, \$121,041; Claude C. Wood, Lodi, \$121,785; Hemstreet & Bell, Marysville, \$126,659. Contract awarded to Jones and King, Hayward, \$107,831.

SAN MATEO COUNTY—Between Lake Lucerne and two miles south of Tunitas about 8.8 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District IV, Route 56, Sections A.B. A. Teichert & Son, Inc., Sacramento, \$287,361; Fredrickson & Westbrook, Sacramento, \$304,168; Eaton & Smith, San Francisco, \$304,748; Heafey-Moore Co.-Fredrickson & Watson Construction Co. & H. Earl Parker, Oakland, \$307,192; Granfield, Farrar & Carlin, San Francisco, \$308,719; Jones & King and Fredrickson Bros., Hayward, \$318,232; Macco Construction Co., Clearwater, \$319,704; The Utah Construction Co., San Francisco, \$323,726; Chas. L. Harney, San Francisco, \$357,929; McNutt Bros., Eugene, Oregon, \$381,017. Contract awarded to N. M. Ball Sons, Berkeley, \$281,974.

SANTA CLARA COUNTY—About 0.5 mile south of Los Gatos, a steel girder side-hill viaduct having a length of 926 feet 6 inches to be constructed. District IV, Route 5, Section C, Earl W. Heple, San Jose, \$94,250; Caputo & Keeble, San Jose, \$100,233; A. Soda and Son, Oakland, \$105,810; John Rocca, San Rafael, \$108,076; M. J. Lynch, San Francisco, \$119,640. Contract awarded to Heafey-Moore Co. and Fredrickson & Watson Construction Co., Oakland, \$91,509.

SANTA CLARA COUNTY—On Polhemus Street at San Jose, an underpass under the tracks of the Southern Pacific Co. to be constructed. District IV, Feeder route, Carl N. Swenson Co., San Jose, \$134,860; Caputo & Keeble, San Jose, \$137,600; Trehitt-Shields and Fisher, Fresno, \$140,083; Barrett & Hilp, San Francisco, \$151,428; John Rocca, San Rafael, \$152,627. Contract awarded to Earl W. Heple, San Jose, \$130,497.

SISKIYOU COUNTY—A reinforced concrete slab and steel girder overhead cross-

Relocation in Santa Ana Canyon

(Continued from page 19)

posite the dam site. This portion was graded to a rough grade section including drainage structures, and a roadbed for the Santa Fe Railway tracks. Closely following the completion of this unit, the Division of Highways awarded a contract to V. R. Dennis Construction Company for constructing the highway from Corona to the Orange County line including surfacing the portion constructed under the jurisdiction of the Orange County Flood Control District.

Work on these units was notable for the heavy grading operations. About one mile east of the Orange County line near the head of the Santa Ana Canyon one cut section had a maximum height of over one hundred feet and a length of about one-fourth of a mile. From this huge prism, about ninety thousand cubic yards of gravelly material were selected and processed for surfacing material. The surfacing material was placed on the rough grade to a depth of one foot below profile elevation to provide stability for the plant-mixed surfacing.

As the location of this project was back from the river channel, the new alignment crossed many fingerlike ridges extending from the nearby range of the Santa Ana Mountains. The heavy grading involved in cross cutting these ridges made it necessary, in order to balance quantities, to construct at this time a roadway width adequate for four lanes of divided traffic, rather than to construct for two lanes and later widen for a four-lane section. The westerly one-half mile was constructed to a standard 38-foot section.

For a riding surface, a three-inch thickness of plant-mixed surfacing was placed on the surfacing material. Through the portion graded for an ultimate four-lane, divided highway section the plant-mixed surfacing was placed on the north half of the roadbed in due regard for the future four-lane development.

Bordering each side of the surfacing, shoulders were constructed to a

In Memoriam George Ernest Wotton

With the death of George Wotton on January 1, 1940, the San Francisco-Oakland Bay Bridge has lost a loyal and valuable employee, and his fellow workers, both at the Administration Building and Central Office have lost a valued friend.

Mr. Wotton graduated in May, 1922, from the University of California with a B. S. Degree in Civil Engineering. He was first employed by private consulting engineers in San Francisco and later by the late George Posey in the construction of the tube underneath the Oakland Estuary that bears his name. After the completion of this project Mr. Wotton started to work for the Bridge Department of the State Division of Highways in 1928, as a bridge designer. In September, 1931, he was transferred to the Design Department of the San Francisco-Oakland Bay Bridge where he was employed until his untimely death.

Mr. Wotton was a loyal, capable and conscientious worker, interested in helping others in their work, and always willing to give freely of his own time.

He was born May 7, 1899, in Oakland, California. He attended grade and high schools in that city and the University of California in Berkeley, where he graduated with honors from the College of Civil Engineering. He is survived by his widow Adelyn, his parents, Mr. and Mrs. E. M. Wotton, and three sisters. To these is extended the deepest sympathy of his co-workers and employees of the Department of Public Works.

width of seven feet with a road-mix surface treatment.

The section of new highway is built to modern standards with curves so easy they are not a limiting factor in legal speeds.

In addition to the ever increasing volume of pleasure traffic between the mountain resort areas in Riverside and San Bernardino counties, and the beach areas, the volume of freight traffic between the Long Beach and San Pedro harbors and the farms and cities of the interior counties is also constantly increasing.

In the past few years, the Division of Highways reconstructed this route from the Riverside-Orange County line, westerly through the balance of the Santa Ana Canyon. With the completion of this project, the highway through the entire canyon can now be traversed quickly and safely

Pavement Records for 1939

(Continued from page 24)

as was built in 1938. On the whole, an improvement was made in the riding qualities of this type of road surface.

Construction Records

The record for surface smoothness of plant-mix, 6.5 inches per mile, was made on Contract 08VC6, Road VIII-SBd-26-A, San Bernardino to Santa Ana River. V. R. Dennis Company was the contractor and G. E. Malkson, the resident engineer. The State average for 1939 was 26.0 inches per mile, as compared to 23.5 inches in 1938.

The record for surface smoothness of road-mix type, 6.3 inches per mile, was made on Contract 011XC4, Road XI-Riv-187-F, near Thermal, by Basieh Bros., contractor, and C. R. Hagberg, resident engineer. The State average for 1939 was 31.9 inches per mile, compared to 38.7 inches in 1938.

The record surface smoothness for armor coat surface, 28.1 inches per mile, was made on Contract 04WC5, Road IV-SC1-32-C, one mile east of Bell's Station to three miles west of Merced County Line. Granfield, Farrar & Carlin were contractors, with H. S. Payson, resident engineer. This compares to the record for 1938, when 28.4 inches was averaged on one project.

in contrast to the unpleasantness and the ever present danger element of riding over the short steep grades and sharp curves of less than a decade ago.

Another significant development made necessary by the Prado Dam is the necessity for the relocation of the State highway route between Prado and Pomona. This route is one that is likely to become of major importance due to its strategic geographical location.

As some five miles of this route in the vicinity of Prado is under the ultimate highwater line, its relocation is necessary and will involve reconstruction of between five and ten miles of highway to make satisfactory connections outside of the flood water basin.

State of California
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Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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FRANZ R. SACHSE, Assistant Director

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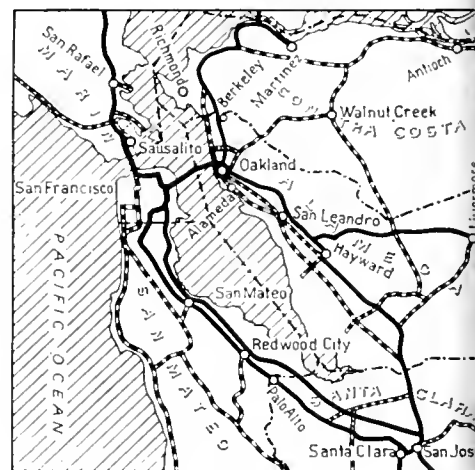
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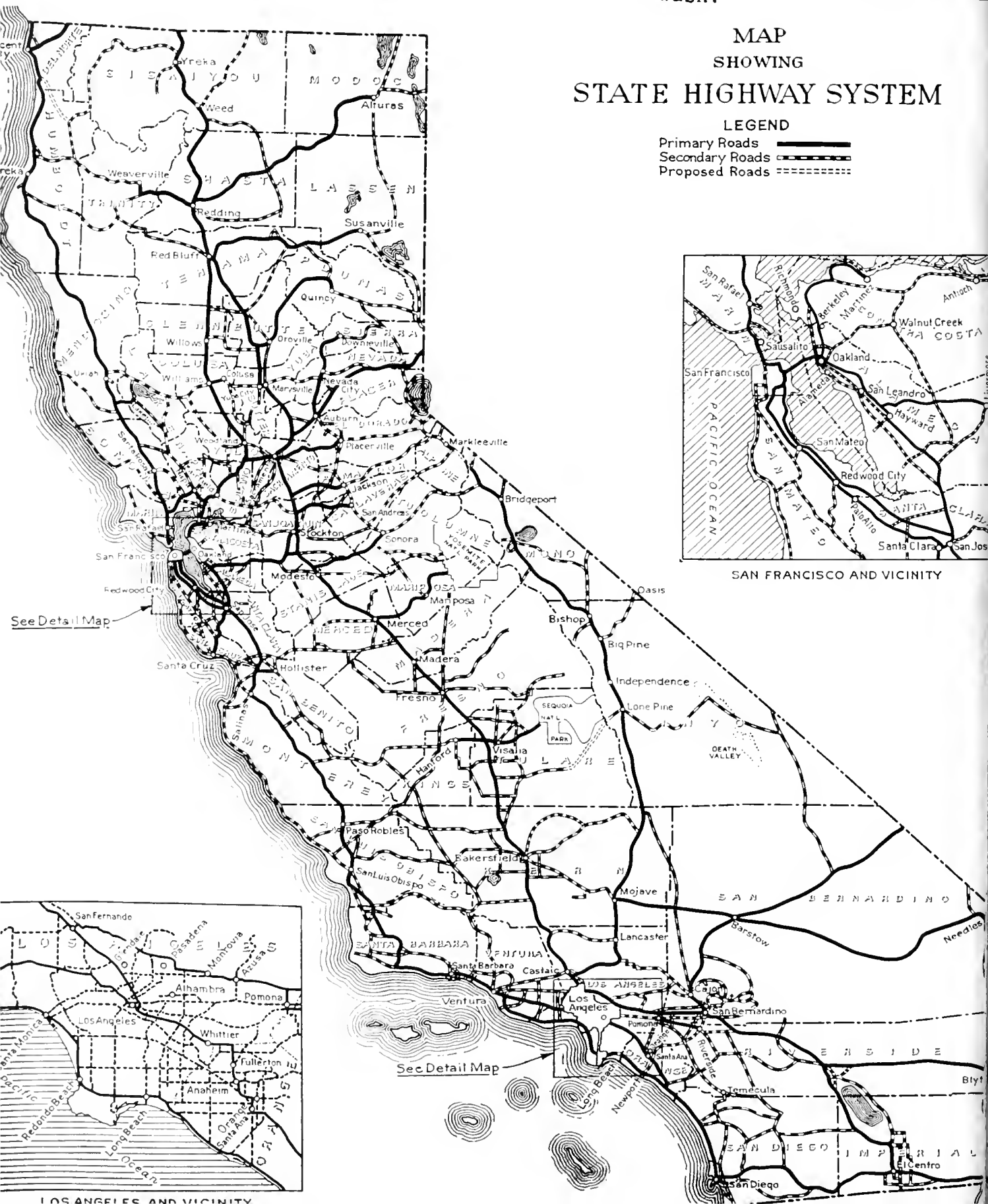
MAP SHOWING STATE HIGHWAY SYSTEM

LEGEND

Primary Roads 
Secondary Roads 
Proposed Roads 



SAN FRANCISCO AND VICINITY



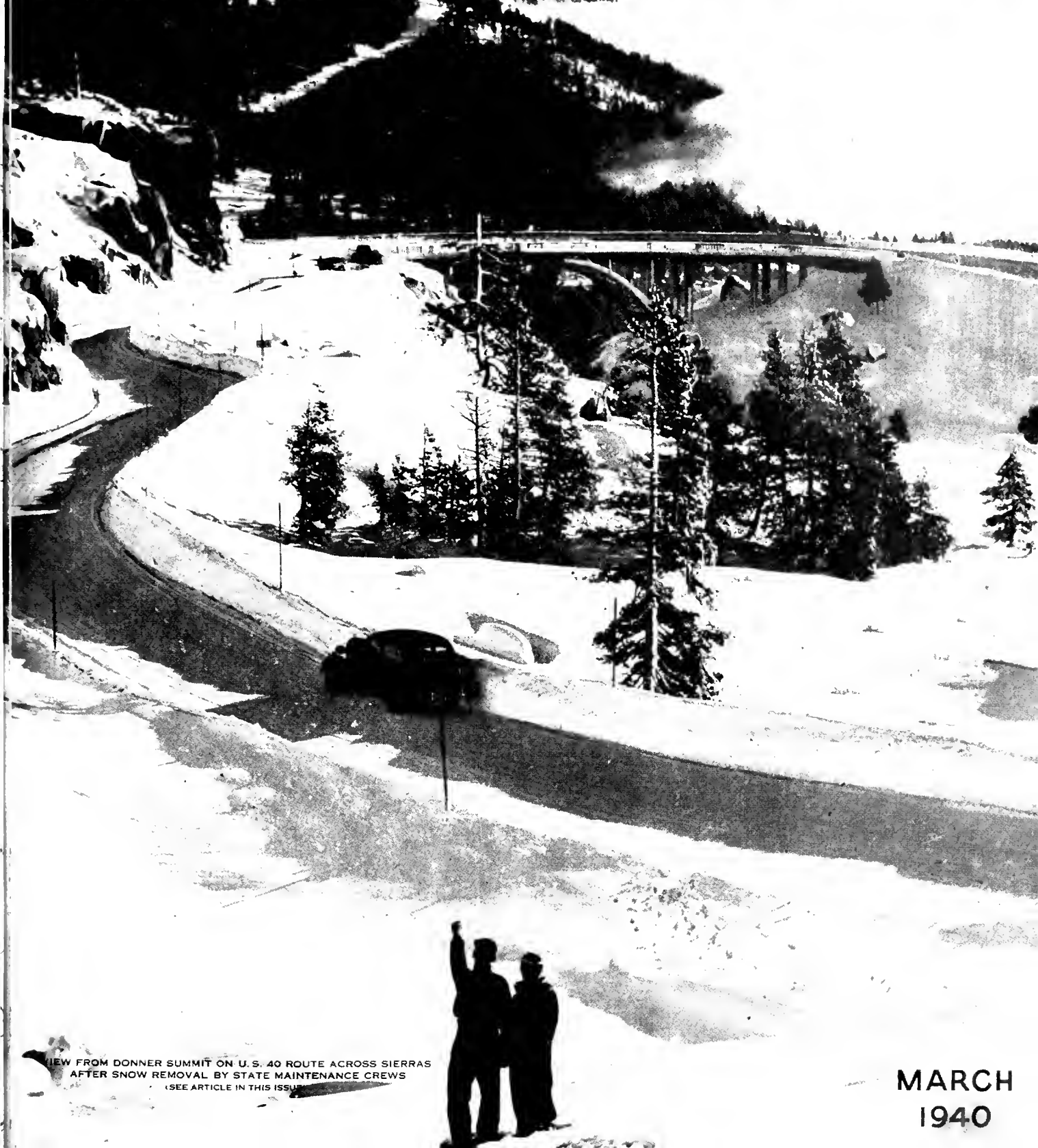
See Detail Map

See Detail Map

LOS ANGELES AND VICINITY

CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



VIEW FROM DONNER SUMMIT ON U.S. 40 ROUTE ACROSS SIERRAS
AFTER SNOW REMOVAL BY STATE MAINTENANCE CREWS
(SEE ARTICLE IN THIS ISSUE)

MARCH
1940

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways of the Department of Public Works, State of California

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

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Flood waters of Sacramento River pour through break in levee north of Colusa.

Storm Damage \$16,000,000

RAIN storms, which in some sections attained cloudburst proportions, wrought havoc to highways, levees and rich agricultural lands in northern California during the period February 25 to 29 and caused damage variously estimated at from \$14,000,000 to \$16,000,000.

When it became evident that the torrential downpours in the Sacramento Valley had created a catastrophe of major magnitude, Governor Culbert L. Olson took personal command of the situation, mobilizing forces of the Department of Public Works, National Guard, Highway Patrol, State Department of Public Health and other State agencies for relief work, the evacuation of flood refugees, protection of the levee systems on the Sacramento, Feather, American and Eel Rivers and other waterways and for the prevention of epidemics among thousands of persons made homeless by raging waters.

The Governor requested and obtained from Washington W. P. A. emergency relief funds totaling \$130,000; ordered the National Guard out in Yolo County to rescue several hundred stranded migrants in the vicinity of Winters and provide them with housing, food and clothing at the State Fair Grounds in Sacramento; directed the Division of Water Resources to assign 650 W. P. A. employees to levee patrol duty to augment State and Federal forces engaged in this work; sent doctors, nurses and sanitary engineers of the Department of Health into flooded areas where water for domestic use had become polluted to guard against disease and appointed an Emergency Council to study requests for assistance from flood-stricken communities to make immediate use of \$1,129,000 of State Emergency Fund monies made available under the Governor's Proclamation (see page 3) that a state of emergency exists.

Director of Public Works Frank W. Clark flung the maintenance crews of the Division of Highways and the entire force of the Division of Water Resources into the battle with the elements. Men of the Maintenance Department in five northern California Highway Districts labored night and day during the storm period with only a few hours time out for sleep. Some crews worked for twenty-four hours and thirty-six hours at a stretch.

As this magazine goes to press, twenty-five northern California counties, including the great Sacramento Valley and the rich Delta lands of San Joaquin are emerging from the disaster and counting the toll of their losses.

Highway Damage Totals \$1,267,200

IN FIVE northern California Highway Districts, flood damage to State highways and bridges during the storms of February 25 to 29 amounted to \$1,267,200 as nearly as can be estimated at this time by Director of Public Works Frank W. Clark.

The damage was concentrated in the twenty-five northwesterly counties. It was particularly severe in the upper and central portions of the Sacramento Valley and was occasioned by waters which surged over banks and levees of the Sacramento, Feather, American, Eel, Trinity and Russian rivers and their tributaries, Cache and Putah creeks in Yolo County and by-passes in Sutter and Colusa counties and by landslides and slip outs.

The entire Peninsula area south of San Francisco also suffered considerably.

The severity of the storm is indicated by data from the records of the Sacramento office of the United States

(Continued on page 6)

Flood Waters Cover 500,000 Acres

FOUR days of torrential rains, beginning on February 25th sent the rivers of Northern California out of their banks, flooding approximately 275,000 acres of farm land and 225,000 acres of by-pass and overflow areas in the Sacramento Valley causing damages to levees estimated at \$500,000. Estimates of the total damage to crops and property range variously from \$10,000,000 to \$16,000,000. Until complete surveys have been made accurate estimates of the total storm damage are impossible.

Beginning with moderately heavy rains, the storm increased in intensity until February 27th when the heaviest rainfall figures were recorded. The full force of the storm centered in the Sierra Nevada along the watershed of the Yuba, Feather and Sacramento rivers. Heavy rainfalls were also recorded along the north coast. South of the American River watershed the storm raged



Thousands of acres of orchards and farm lands were inundated by levee breaks on the Sacramento River north of Colusa.

in short torrential downpours of cloudburst proportions.

As the intensity of the storm increased and it became evident an emergency was imminent, every available engineer in the State Division of Water Resources was assigned to the direction of emergency repair crews, river patrol work and stream gauging. State Engineer Edward Hyatt obtained the services of 650 W.P.A. workers for emergency work on levees and patrol work. In addition hundreds of others volunteered for patrol duty and aided in sandbagging weakening levees.

SACRAMENTO RIVER ON RAMPAGE

Chief destructionist of the storm was the mighty Sacramento River which went on a rampage of record proportions. As the crest of the flood waters swept southward, new high water records were set by the Sacramento at all points from Kennett to Knights Landing where the by-pass system took the brunt of the burden.

The four days of rains, the heaviest of which struck the watershed above Kennett, where Shasta Dam is now

under construction, sent the Sacramento River stage to 36.3 feet at the Kennett gauge of the United States Weather Bureau. This is 3.1 feet above the highest stage ever recorded by the bureau at that point, which was in 1907, when the gauge recorded 33.2 feet, and 7.3 feet above the 29-foot crest at Kennett in the 1937 flood.

First city to feel the full force of the raging river was Redding, where 500 people were forced to flee from homes in the low-lying sections in the outskirts of the city. The city filtration plant was temporarily put out of commission, the new Southern Pacific railroad bridge and highway bridges leading into the city damaged, and portions of Anderson-Cottonwood Irrigation Canal washed out.

In the Sacramento River canyon between Redding and Dunsmuir slides on the Southern Pacific right-of-way blocked rail traffic until March 5th.

FARM LANDS INUNDATED

As the crest of the flood surged southward it broke through levees inundating many thousands of acres of fertile farm lands, driving hundreds

from their homes, drowning stock that was caught in the lowlands and wreaking general havoc. It is estimated that 6,000 people were forced to flee from their homes.

However, not all of the damage came from the Sacramento River. Orland and Hamilton City were caught in the overflow of Stony Creek and flooded. The water following the main highway into Orland spread out through the residential and business district. Families west of Orland were evacuated in boats. The water reached a depth of eight feet in parts of that area.

On the east side of the Sacramento River, Mill and Deer Creeks left their banks flooding large areas of wheat lands adjoining the Sacramento Highway, traffic on 99E was completely cut off at Vina for three days. Below Chico flood waters from Butte Creek and from Feather River overflow above Honcut spread out over hundreds of acres of land and the highway from Durham south to Biggs was under water most of the distance. Butte Creek also fanned out into the Butte Basin.

MIGRANTS DRIVEN OUT

At Marysville, the swollen Yuba River drove 450 migrants from a government migrant camp located in the river bottom. The Feather River effectively blocked rail traffic on the Southern Pacific when the water poured over the railroad bridge between Marysville and Yuba City.

There were sixteen breaks in the Sacramento River levees above Princeton—five on the east side and eleven on the west side. All of the breaks were in levees which were below standard either as to grade section or both, and are scheduled for completion under the project construction program.

Water from the breaks on the east side of the river went into the Butte Basin, isolating Butte City although there was no damage in the town. Much of the land in the Butte Basin is devoted to gun clubs and grazing lands. The state owns flowage rights through the basin and comparatively little crop damage is anticipated. Some rice and grain lands were inundated along Butte Creek.

On the west side of the river the eleven breaks in the levees flooded many thousands of acres and isolated the towns of Princeton and Colusa. The waters fanned out in another al-

(Continued on page 4)

Proclamation

WHEREAS, extraordinary floods have occurred on the Sacramento River and its tributaries, inundating populated areas and thousands of acres of highly developed farm lands and forcing hundreds of families from their homes; and

WHEREAS, there are many breaks in the levees protecting said areas; and

WHEREAS, unless said levees are repaired the normal spring freshets and melting snows will raise the rivers and streams in the Sacramento River basin and cause water to flow out through these levee breaks and further inundate parts of said lands and prevent their rehabilitation and the resettlement of their population thereon; and

WHEREAS, unless said levee breaks are repaired and the population of said areas returned to their homes and farms, they will be prevented from earning their livelihoods and will require public assistance,

NOW, THEREFORE, I, Culbert L. Olson, Governor of California, pursuant to the provisions of Chapter 662, Statutes of 1929, and pursuant to the recommendation of the State Emergency Council, do hereby declare an emergency to exist within the boundaries of the basin of the Sacramento River and its tributaries, and I hereby instruct the Director of the Department of Public Works of the State of California to make an immediate survey of said area, and to determine the location and extent of the damage caused by the past floods, of levee breaks, of the potential danger of further floods at the time of the spring freshets, and of the best method of rehabilitating the inundated lands within said area and restoring the population of said lands to their homes and farms, and to take such further steps as are necessary to rehabilitate said area and its population.

Flood waters surging through levee breaks inundated portions of Princeton. This photo shows cattle marooned on railroad tracks.





most unbroken stretch extending from Hamilton City south to Knights Landing where they drained into the Yolo By-pass.

SUTTER BY-PASS LEVEE BREAKS

On the east side of the river, the flood waters augmented by heavy run-offs from tributary streams formed a vast lake extending from Vina south to the Tisdale By-pass, an airline distance of approximately 65 miles and varying in width from three to five miles.

A break in the west levee of the Sutter By-pass north of Meridian flooded Reclamation District 70 despite the efforts of crews of workers who stayed on the job until marooned by the flood waters. They were forced to remain on the levee for 18 hours before being rescued. The State had 120 men on patrol duty on the east levee of the Sutter By-pass which held. The north levee of the Tisdale By-pass broke flooding Reclamation District 1660, which adjoins District 70 on the south. About 35,000 acres of fine farming and orchard lands were flooded by these two breaks.

As the crest of the flood moved south it continued to set new high records. At Colusa it reached a stage of 29.5 feet which was 2.7 feet above the crest at that point in 1937. At Knights Landing the river reached 34 feet, compared to the 32.6-foot crest in 1937.

SACRAMENTO WEIR OPENED

At Sacramento, on February 27th, Public Works Director Frank W. Clark ordered the flood gates of the Sacramento Weir opened when the river passed the safety stage at 28.3 feet. With the weir gates opened the river at Sacramento dropped to 26.5 feet and at no time seriously



Governor Culbert L. Olson visits flood refugees housed at State Fair Grounds after their evacuation from Yolo County lowlands by National Guardsmen.

threatened the city. The flood gates between Sacramento and North Sacramento were closed on February 26th, shutting off traffic between the two cities.



Harold E. von Bergen, who lost his life in line of duty.

One of ten victims claimed by flood waters, Harold E. von Bergen, Assistant Hydraulic Engineer of the Division of Water Resources, lost his life in line of duty on February 28 while

engaged with two other members of the Division staff in measuring the flow of water pouring through the Sacramento weir into the Yolo by-pass.

Fred Paget, Associate Hydraulic Engineer, and Duncan F. McCallum, Automatic Water Ganger Mechanic, escaped death in the turbulent by-pass, which was filled to capacity by the opening of the Sacramento weir on the Sacramento River. Paget swam ashore when the boat in which the three men were working capsized, and McCallum was picked up downstream by a boat in which United States army engineers were taking measurements.

When Paget reached shore, he saw von Bergen still afloat and then lost sight of him. The fact that von Bergen was a strong swimmer gave rise to faint hopes that he might have

(Continued on page 21)

Top picture on the adjoining page shows the force of the flood breaking through a levee near Colusa where the swirling waters covered thousands of acres of adjacent farm lands. Left center—Stephens Bridge, a county structure that was wrecked when the flood waters in Cache Creek swept over its banks in Yolo County with unprecedented force. Right center—Street flooded and closed to traffic in Napa City when Napa River rose and swept through the town. At bottom—State highway flooded by waters that spread over the surrounding country through a break in Sutter by-pass levee.





Wreckage of former county bridge on Sacramento River at Redding, State Route 44.



Highway slip-out on State Route 104 along Russian River near Guerneville.



U. S. Highway 99E flooded near Biggs, Butte County.

Weather Bureau at selected locations, and more particularly for the two days February 27 and 28.

Traffic was first inconvenienced when water overflowed the pavement at innumerable points. As the storm increased in intensity, it was necessary to close roads at certain points and eventually entire routes. This applied especially to roads crossing or immediately paralleling the Sacramento River in Glenn, Colusa and Yolo counties.

The Division of Highways forces made every effort to provide and sign detours, and to inform the public. All districts were coordinated in this respect. The newspapers, and particularly the radio stations—KFBK, KPO, KGO, KSFO, KROW and KROY—were very helpful in broadcasting information furnished them by the Division at almost hourly intervals.

Rainfall Records

Location	County	Rainfall in Inches	
		Feb. 27 and 28	Feb. 25 to 29 inclusive
Montgomery Creek, Shasta*		4.78	9.02
Red Bluff, Tehama		3.60	4.10
Stirling City, Butte		15.20	20.07
Downieville, Sierra		11.30	15.98
Nevada City, Nevada		7.59	11.91
Gold Run, Placer		6.54	11.03
Middletown, Lake		10.73	12.98
Beegum, Trinity		12.30	16.00
Garberville, Humboldt**		6.36	9.50

It is also reported that 8.75 inches of rain fell in the Santa Cruz area in a 17-hour period.

* Four days recorded.

** Division of Highways record.

MAJOR ROUTES CLOSED

The major routes which were closed for periods of a few hours to two days by high water are as follows:

U. S. 40—At underpasses east of Sacramento; between the Causeway and Davis, and at Putah Creek.

U. S. 99W—Davis Wye to Tehama County line at points north and south of Woodland, Arbuckle, Williams, Willows and Orland; at bridge north of Redding; at Pollock.

U. S. 99E—North of Biggs; at Los Molinos and Cottonwood.

The following routes suffered major damage:

U. S. 101—Cloverdale to Hopland on account of slipout, and at Scotia on account of bridge failure.



Four hundred foot slip-out on Redwood Highway, U. S. 101, north of Cloverdale—Photo courtesy San Francisco Examiner.

State Sign Route 1—Santa Cruz to San Francisco, and from Jenner to Ft. Bragg, due to heavy slides.

State Sign Routes 12 and 29—All roads in vicinity of Napa due to high water in the Napa River.

State Sign Route 20—Redwood Highway to Williams and Williams to Yuba City, and east of Marysville due to flooded sections.

U. S. 299—Arcata to Weaverville, due to slides and washouts.

State Sign Route 44—The east timber approach to the former county Free Bridge east of Redding washed out on February 27.

State Sign Route 24—The Feather River route was closed by washouts and slides from about six miles west of the Butte-Plumas County line to Greenhorn Creek east of Quincy.

State Sign Route 12—Between Sebastopol and Monte Rio on the Russian River, due to floods and slip-outs.

State Highways 45, 47 and 88 in Glenn and Colusa counties are still flooded due to break in the levees of the Sacramento River, and there is a major break on Route 99 north of Rio Vista at Cache Slough.

(Continued on page 27)

Highway Damage Totals \$1,267,200 In 5 Districts

Major highway routes in Northern California are open to traffic following the severe storms during the last week of February. The Scotia Bridge in Humboldt County on the Redwood Highway was put into service on March 4.

The flood damage to highways was confined principally to five highway districts as follows:

District I—Eureka

Mendocino, Humboldt, Lake, Del Norte and portions of Trinity and Colusa counties..... \$280,500

District II—Redding

Tehama, Shasta, Plumas, Trinity and portions of Siskiyou counties 507,400

District III—Marysville

Glenn, Colusa, Yuba, Butte, Sutter, Yolo and Sacramento counties 97,000

District IV—San Francisco

Sonoma, Napa, Marin, Contra Costa, Alameda, San Mateo, Santa Clara and Santa Cruz counties..... 330,000

District X—Stockton

Portions of Sacramento, Solano and San Joaquin counties 52,300

\$1,267,200



Rough grading operations on Mint Canyon Cut-off, with tractors pulling 25 and 28 cubic yard carryall scrapers.

Building Mint Canyon Cut-off

By R. C. MYERS, Assistant District Office Engineer

CONSTRUCTION on the final contract of the "Mint Canyon Shortcut" in Los Angeles County is now well on its way toward completion and the benefits of this 5.2 mile saving in distance to users of the Mint Canyon Highway (U. S. Highway Routes 6 and 395) will begin to be realized during the latter part of next summer.

The entire project, which extends from Tunnel Station, about one mile southerly of the old Newhall tunnel, to Solamint on the Mint Canyon Highway, is being done under four separate contracts, actual construction work having been started in May, 1938.

The first of these contracts extended from Tunnel Station along the old San Fernando-Newhall Road to a point about four-fifths mile northerly of the tunnel and thence on a diagonal line toward Solamint, ending at Placerita Creek.

The letting of this contract was shortly followed by two other contracts, one being for a new reinforced concrete bridge across the Santa Clara River near Solamint and the other for an overhead crossing of the Southern Pacific railroad at Solamint.

THREE CONTRACTS COMPLETED

These three contracts have been completed, the immediate benefit being the elimination of the Newhall Tunnel by making an open cut through the summit of the Newhall mountains and the widening, straightening and improving alignment on two miles of the old San Fernando-Newhall road from Tunnel Station to the point where the "Short Cut" starts.

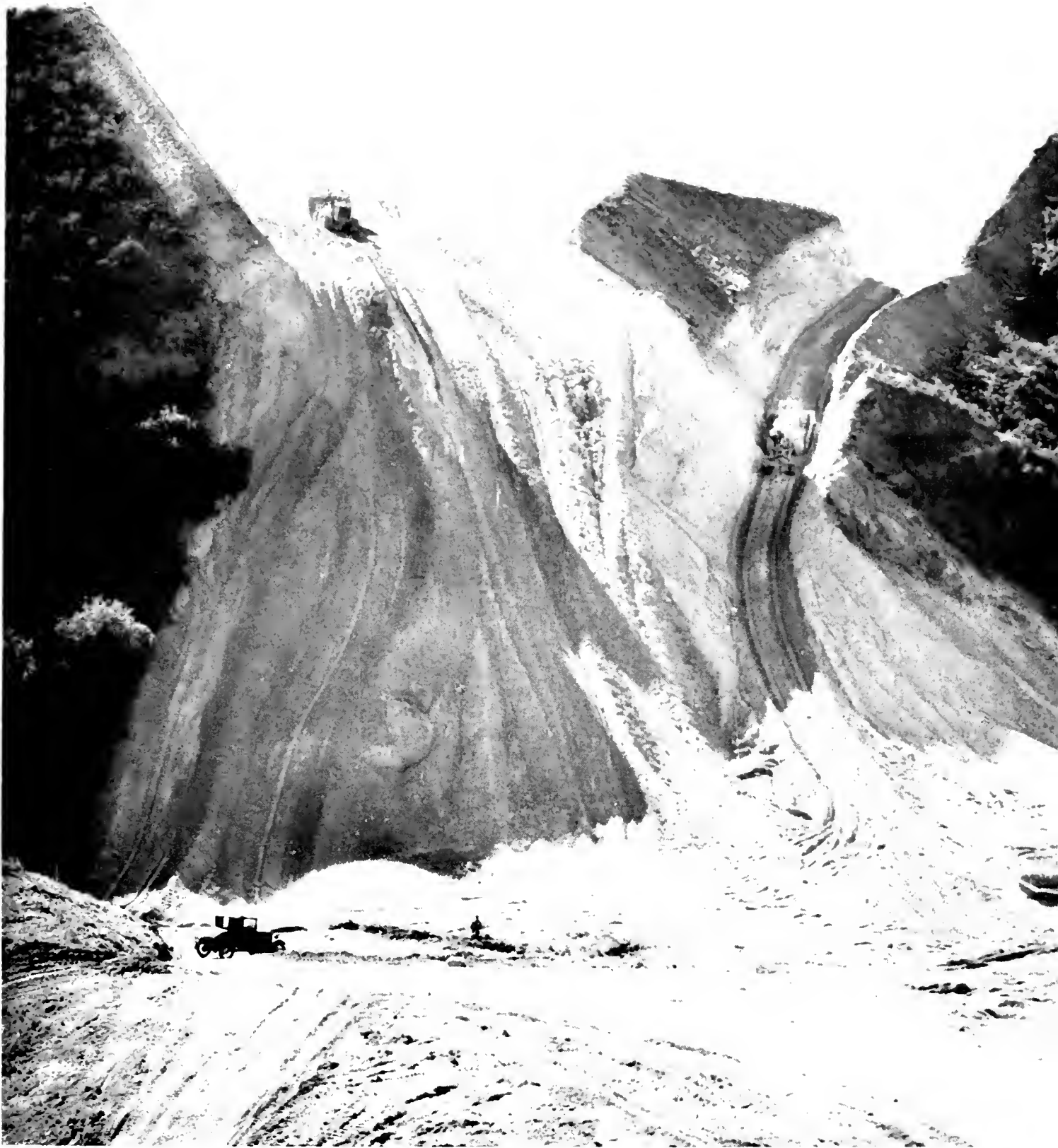
It remains for the fourth and present contract to "fill in the gap" from Placerita Creek to the Solamint Junction, thereby putting into service the new diagonal road which will save 5.2

miles in distance to automobile traffic (averaging 4000 cars daily) which uses the Mint Canyon Highway (U. S. Highways 6 and 395) between Los Angeles and Mojave and points northerly therefrom.

The project as a whole is essentially a large "dirt moving" job, there being 1,520,000 cubic yards of excavation along the 7.13 mile distance between Tunnel Station and Solamint handled under the two grading contracts.

The "Short Cut," which includes the present contract (3.40 miles) and 1.73 miles graded and paved under a previous contract, is being surfaced to a width of 33 feet (3 traffic lanes) except for 2000 feet at the summit of the hilly country which it traverses. Through this section, on account of somewhat impaired sight distance, the surfacing will be 46 feet in width (4 traffic lanes).

(Continued on page 20)



Pioneering 134-foot cut and 70-foot fill down natural slope of 5:4 in Mint Canyon Cut-off grading operations.

Palm Springs Relocation Includes Grade Separation and Underpass

By A. EVERETT SMITH, Assistant Highway Engineer

IN ADDITION to normal traffic increase, the ever growing popularity of the desert recreation and resort areas in Southern California has presented definite traffic demands for improved highway facilities to such areas. This is especially true of the portion of the State highway between U. S. Highway 99 and Palm Springs in Riverside County. This portion is on State Sign Route No. 111 and branches from U. S. 99 a little over one mile west of Whitewater. It forms an alternate route to Indio via Palm Springs and Cathedral City.

other. To this at seasonal periods are added throngs of motorists who seek the warm desert sunshine, the beauties of the lavish beds of wild flowers, or a visit to their favorite desert resort.

At the junction of U. S. Highway 99 and State Sign Route 111 the "Magic Eye" traffic counter has recorded over 15,000 vehicles in a single day. Traffic flow charts show that a large portion of this traffic goes to Palm Springs.

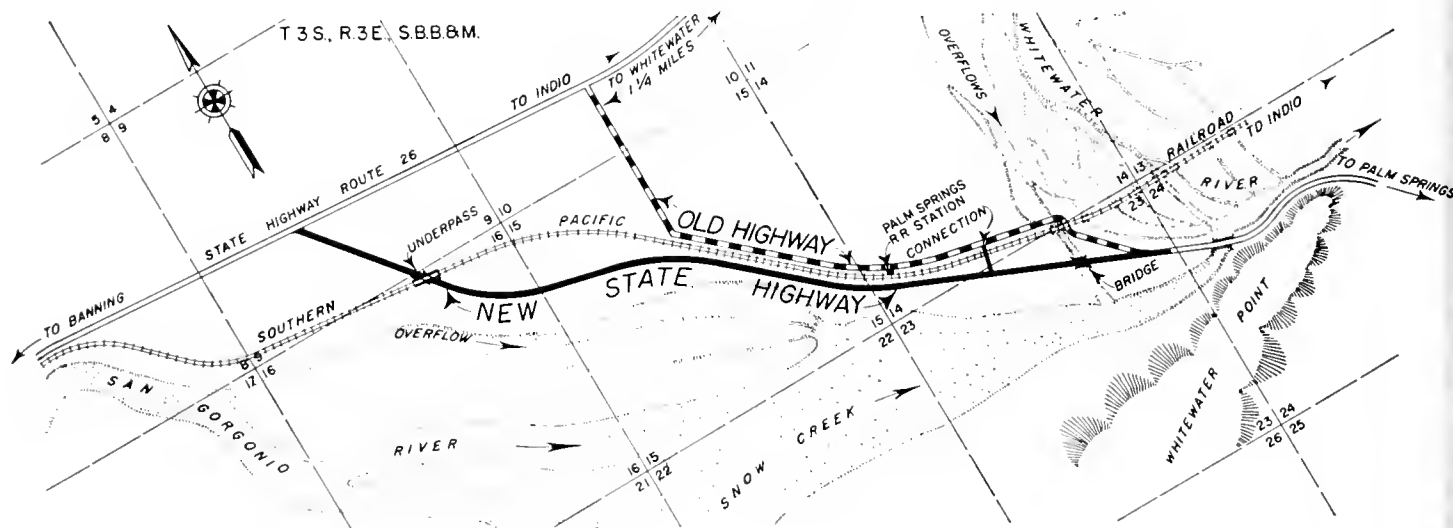
As the portion of the Palm Springs road between Whitewater and Snow

ent through Whitewater Point.

The superseded portion of the old road had numerous sharp curves and an irregular grade that followed the natural ground line. Abrupt turns on each side of a grade crossing over the tracks of the Southern Pacific Company constituted a traffic menace.

This old road is replaced by the new project which follows along the south side of the railroad to a vantage point and crosses under the tracks by an underpass structure.

The project, in general, consists



U. S. Highway No. 99, going easterly from Los Angeles, proceeds through the San Geronimo Pass, and passes through Banning, Whitewater and Indio. Due to the rugged mountain ranges, a number of major highways converge and use the San Geronimo Pass in common. They are U. S. Highways 99, 60 and 70.

This causes a heavy concentration in traffic through this portion and traffic congestion is accentuated by freight and produce trucking to and from the Coachella and Imperial Valleys on one side and the Los Angeles metropolitan and harbor areas on the

Creek was substandard, a section of new highway was constructed from Snow Creek northwesterly to an intersection with U. S. 99 about a mile west of the old Whitewater Junction. This improvement, 3.15 miles in length, is on new alignment and forms the hypotenuse of a triangle reducing the distance of the old road representing the two legs of the triangle, by three-fourths of a mile. The southeasterly end of this project connects with an improvement completed in 1937 a unit of which was a new modern bridge structure across Snow Creek. A standard type highway was

of a 38-foot graded roadbed surfaced with oil-mix, the underpass structure, a bridge across an overflow channel of the Whitewater River, and a connecting road across the tracks to Palm Springs Station.

As the native material used in constructing the graded roadbed did not contain adequate binding properties to form a stable subgrade, a road-mix surface treatment was applied to the entire width of the roadbed to a depth of four inches. This was topped with a riding surface of plant-mixed surfacing.

Storm drainage originates on the slopes of the San Bernardino Mountain range to the north and flows southerly to the foot of San Jacinto Mountain where it unites with Snow Creek and flows to the Salton Sea. This drainage is intermittent, occurring with storms and subsiding soon after. The overflow channel of the Whitewater River is usually a dry wash but with a typical desert cloud-burst may become a torrent.

Over this channel was constructed a bridge consisting of seven, thirty-foot reinforced concrete slab spans on reinforced concrete piers and two, eight-foot cantilever spans. The bridge provides a clear roadway width of 26 feet. Roadway embankments adjacent to the bridge were protected from storm damage by rock riprap. The rock was obtained from a point of the mountains east of Snow Creek Bridge.

The grade separation structure consists of three forty-six-foot eight-inch steel beam track spans with ballasted steel deck on concrete piers and abutments with wing walls. This structure also provides a clear roadway width of 26 feet. To protect the underpass from the cross flow, large ditches and dikes were constructed to intercept and divert the storm water.

During the construction of the underpass the railroad traffic was carried on a shoofly track. Highway traffic used the old road and was maintained at each end while the connections were being constructed.

Engineer McBroom Wins Bridge Design Prize

For a timber bridge design submitted in a nation-wide contest sponsored by the National Lumber Manufacturers' Association, the American Forest Products Industries and the Timber Engineering Company, E. H. McBroom, Associate Bridge Engineer of the Division of Highways, has been awarded second prize of \$200.

At top—Underpass beneath railroad on Palm Springs realignment. Below—Reinforced concrete slab bridge on reinforced concrete piers over Whitewater River overflow channel and view at south-east end of project where road crosses Snow Creek and cuts through point of San Jacinto Mountain. At bottom—View of portion of highway looking toward San Jacinto Mountain en route to Palm Springs. Snow Creek on left.



Snow Clearing Job On the Donner Summit Highway

THE main transcontinental highway from northern California to the East, known as U. S. 40, crosses the summit of the Sierra Nevada Mountains through Donner Pass at an elevation of 7,130 feet. This pass is named for the Donner Party, which met disaster during the winter of 1847 while attempting to cross the mountains to reach California. Deep snow on the summit is no longer an impassable barrier. The route which the old Emigrant Trail followed is now traversed by a modern highway, which is kept open to all year travel.

The high Sierras however, still offer definite winter hazards, and the Donner Summit road is kept open under as severe climatic conditions as are encountered anywhere in the United States. During the winter of 1937-1938 the total snowfall at Soda Springs was 592 inches. The season 1938-1939 was regarded as a mild winter, the fall being only 284 inches. The fall at Soda Springs during the present season up to March 2, 1940, has been 321 inches.

Maintenance of the Donner Highway as an all-year route dates from 1931, and since that time travel over the summit has been halted or delayed only during periods of exceptionally heavy storms. During the winter of 1938-1939 the road was closed to heavy trucking a total of only 39 hours, the longest single period being twenty-two hours during the blizzard of February 7 and 8, 1939. So far, during the present season, trucking has been held up for only six hours during the storm of February 17.

Snow removal equipment assigned to this highway consists of five rotary snow plows, six four-wheel-drive push plows and several graders and small miscellaneous units. The value of this equipment is about \$125,000.

The cost of keeping the Donner Highway open to winter travel, including the sanding of icy pavement, varies with the severity of the winter, the high point being reached during the season 1937-1938, when expenditures amounted to \$86,130. The



MORGAN KEATON

average cost of the last three winters has been \$82,706 per season.

Travel on the Donner Highway includes both through traffic and, at certain times, a considerable volume of recreational travel, which is attracted by the high Sierra snow sport areas. The average Monday traffic over the summit during January, February and March of 1939 was 480 vehicles per 24 hours, and the average Sunday traffic was 960 vehicles. Monday traffic at Baxters is about the same as at the summit, but a Sunday count at Baxters has shown as many as 1429 vehicles at that point during the eight hour period from 8.00 a.m. to 4.00 p.m.

A recent analysis of snow clearing expenditures shows that the cost of this work on the Donner Highway has averaged \$12.52 per 1000 vehicle miles of travel on the route. When it is remembered that the present State gasoline tax of 3¢ per gallon is equivalent to \$2.22 per 1000 vehicle miles of highway travel, and that only half of this, or \$1.11 per 1000 vehicle miles is available for State highway purposes, it is obvious that highway travel through snow country does not, of itself, provide the money which is necessary to keep the highway open to winter travel.

Morgan Keaton Takes Office as Deputy Director

Veteran of the World War and former Adjutant of the American Legion, Department of California, Captain Morgan Keaton on February 17 was given a civil service appointment as Deputy Director of the Department of Public Works by Public Works Director Frank W. Clark, a position he formerly held from November, 1932, to August, 1934.

Keaton, whose home is in San Francisco, was a member of the State Assembly during the 1927 and 1929 sessions, representing Long Beach and Los Angeles County. Since the formation of the American Legion, Keaton has been active in veterans' affairs. He was Adjutant of the California Department of the Legion from October, 1921, to July, 1924.

Born in Copper Hill, Virginia, October 21, 1891, Keaton was educated in the grammar school of Floyd County, Virginia, the Roanoke College of Salem, Virginia, and majored in political science and political economy at the Washington and Lee University of Lexington, Virginia. At the conclusion of the World War, Keaton, who had served one year overseas, took a political economy and law course in the University of Paris in France. Prior to the World War, Keaton was a newspaper man in St. Paul, Minnesota, and gave up his profession in 1916 to join the National Guard, First Minnesota Infantry, for service on the Mexican border, 1916-1917. Enlisting as a private, Keaton was discharged in August, 1919, as a captain, Infantry Reserve Corps.

In 1921 Keaton engaged in the real estate business in Sacramento, and from 1924 to 1930 was in the insurance and real estate business in Long Beach. As secretary and managing director of the California Highway Council, 1935-1936, he managed a campaign for an initiative measure to place in the State Constitution a requirement that all highway funds must be used for highway purposes.

Since 1937 to February 17 he was merchandising counselor of the California Retail Grocers and Merchants Association.

Realignment of U.S. 40 Between Sacramento and Dixon Started

By R. E. PIERCE, District Engineer

WITH the awarding by Director of Public Works Frank W. Clark on March 1 of a contract to Fredrickson Bros. of Emeryville for the grading of 7.3 miles of roadway and installation of drainage facilities, a start was made on a much-needed improvement of an important cross-state highway in the northern part of California; namely, U. S. 40, extending from San Francisco and the East Bay metropolitan area through Sacramento and over

Between the limits of the proposed work, the present highway curves total 617 degrees, whereas the proposed highway will have but 144 degrees.

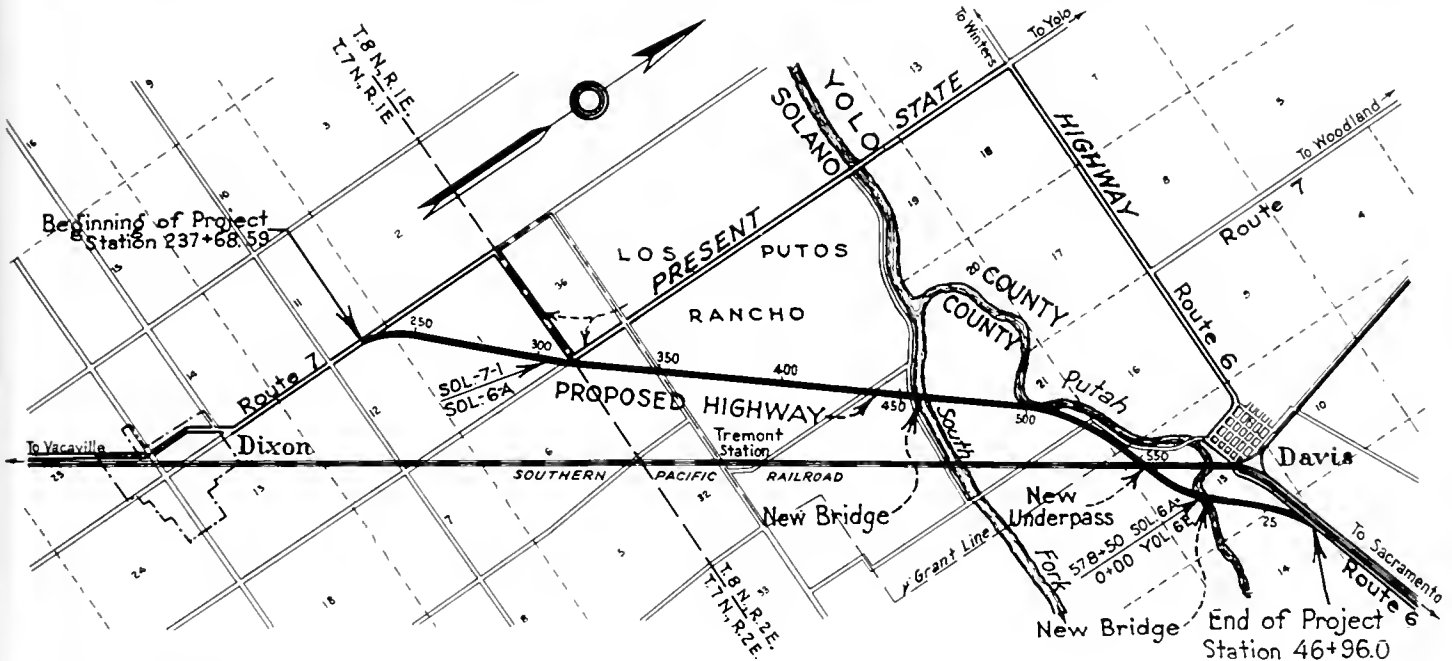
WILL BY-PASS DAVIS

As long ago as 1920 this condition was criticized in the report presented in that year by the then United States Bureau of Public Roads to the California Highway Commission and Highway Engineer entitled "A Study

a new location which, as indicated on the map, will eliminate all the undesirable alignment between Dixon and Sacramento, as well as by-pass the town of Davis, and shorten the distance 3.25 miles.

The present contract starts on the existing State highway 1.3 miles north of Dixon and extends over new rights of way for approximately 7.3 miles to the existing State highway about 1.0 mile east of Davis.

The first 5.0 miles are to be graded



Map of U. S. 40 realignment between Dixon and Davis showing elimination of right angle turns by shorter, more direct route.

Donner Pass to the State line and beyond.

The Frederickson contract was for \$127,301.35.

The location of the present highway between Dixon and Sacramento, in common with most of the early built State highways, was largely controlled by the then existing county roads which, in turn, were often laid out along section lines. This, as indicated on the map, introduced a number of right angle turns and considerable adverse distance.

of the California Highway System."

The last paragraph on page 118 of the report reads as follows: "Solano 7 and Yolo 7—(Benicia-Sacramento). There are some locations on this road that indicate too close an adherence to the old right of way, notably between Fairfield and Vacaville. North of Dixon are two right angle turns in order to follow section lines, and this is repeated north of the Yolo County line."

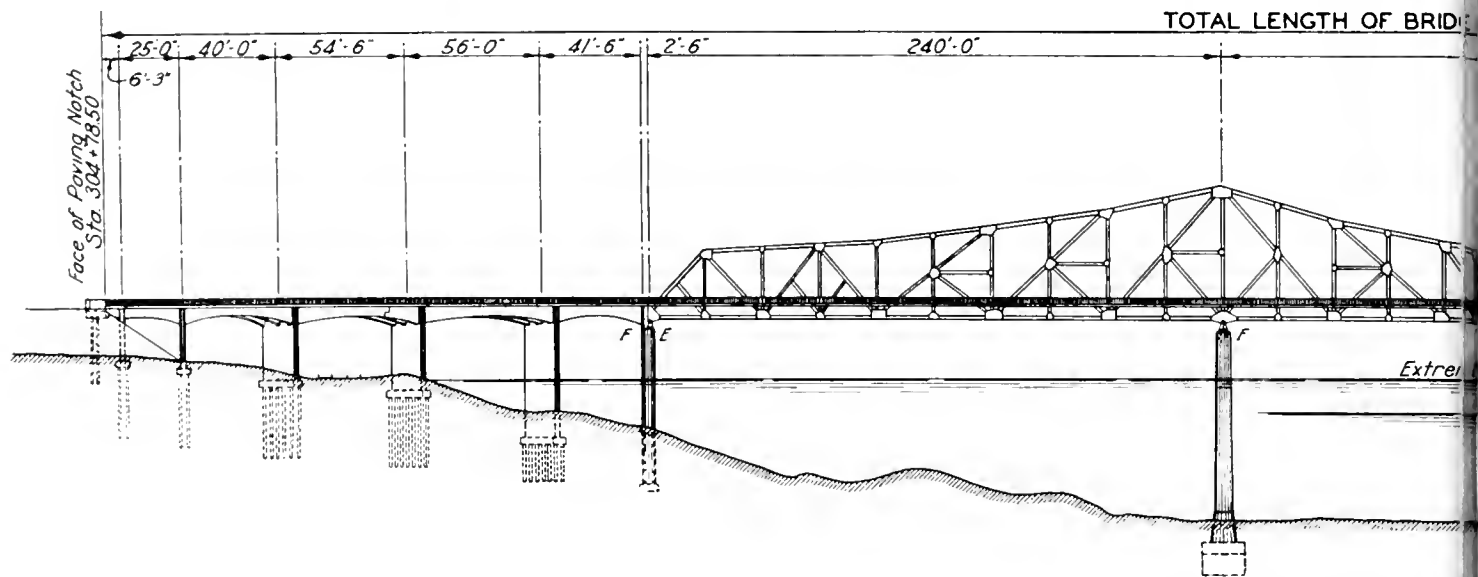
The present project includes grading and minor drainage structures on

for two lanes located off the center of the right of way so as to conform to an ultimate four-lane divided highway. The balance of the grading will be for a four-lane divided highway.

About 1.5 miles from the beginning of this project, the new location is close to the second right angle turn north of Dixon. It is planned here to grade a section of divided highway extending a short distance on either side of the intersection, to make it possible to better care for traffic.

(Continued on page 24)

Two Steel Bridges Under Construction Across E



By A. J. MEEHAN

MOTORISTS driving north from the town of Scotia in Humboldt County on the Redwood Highway in July, 1941, will have the pleasure of traversing two new State bridges across the Eel River, contracts for which were awarded by Director of Public Works Frank W. Clark, last month.

One of the structures will be known as the North Scotia Bridge, crossing both the river and the railroad tracks of the Northwestern Pacific Railroad and the Pacific Lumber Company. The second structure, at a point about

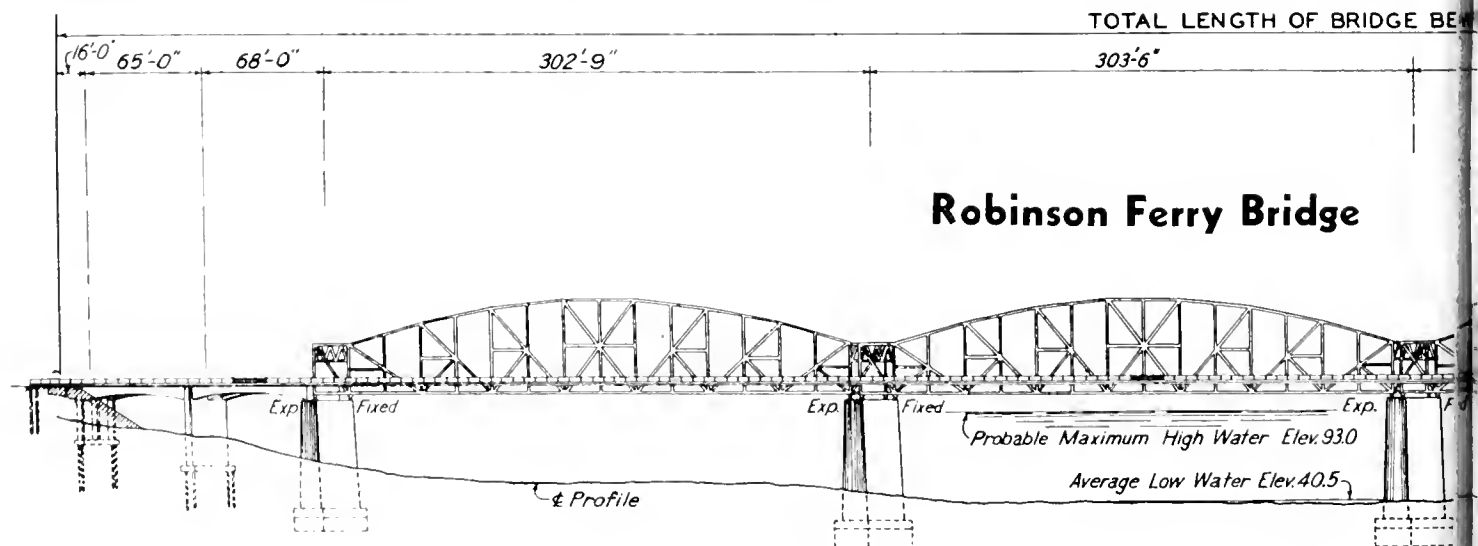
a mile farther on, will span the river at Robinson's Ferry. Between the two will be approximately three quarters of a mile new straight highway, which will materially shorten the existing roadway between the present antiquated bridges at Scotia and Robinson's Ferry, failure of which, due to truck overloading or speeding, would paralyze traffic, as there is no convenient detour.

For financing the new bridges approximately equal amounts of money will be contributed from Federal Aid and State funds. Incidental work

will provide for grading, the installation of a conduit system for future lighting on the North Scotia Bridge and the ultimate removal of both the original bridges after detour use.

The bridge work was let in two contracts since each job was big enough to attract responsible bidders. Separate contracts attract more bidders and thus increase competition to the benefit of the State. They also speed up construction operations and open the projects earlier for public use.

On January 24, 1940, the low bid for the Robinson Ferry Bridge of



Robinson Ferry Bridge

Eel River on Redwood Highway in Humboldt County

TO FACE OF PAVING NOTCHES = 1142'-3"



Senior Bridge Engineer

\$455,580 was submitted by the contracting firm of Engineers Limited of San Francisco. On February 15, 1940, the low bid for the North Scotia Bridge of \$330,000 was received from A. Soda & Son of Oakland.

In a rugged and almost inaccessible area five thousand feet above sea level in the San Hedrin Mountains of California's northwestern coastal range, the Eel River starts winding its way to the sea. The drainage basin of the Eel River is approximately 3100 square miles, much of which, being generously timbered, presents a drift

problem at bridges. Normally the annual rainfall is one hundred inches in the upper fringes of the watershed. The casual observer is apt to judge the "might" of a stream by its width and in the case of the Eel River would easily overlook its potentialities.

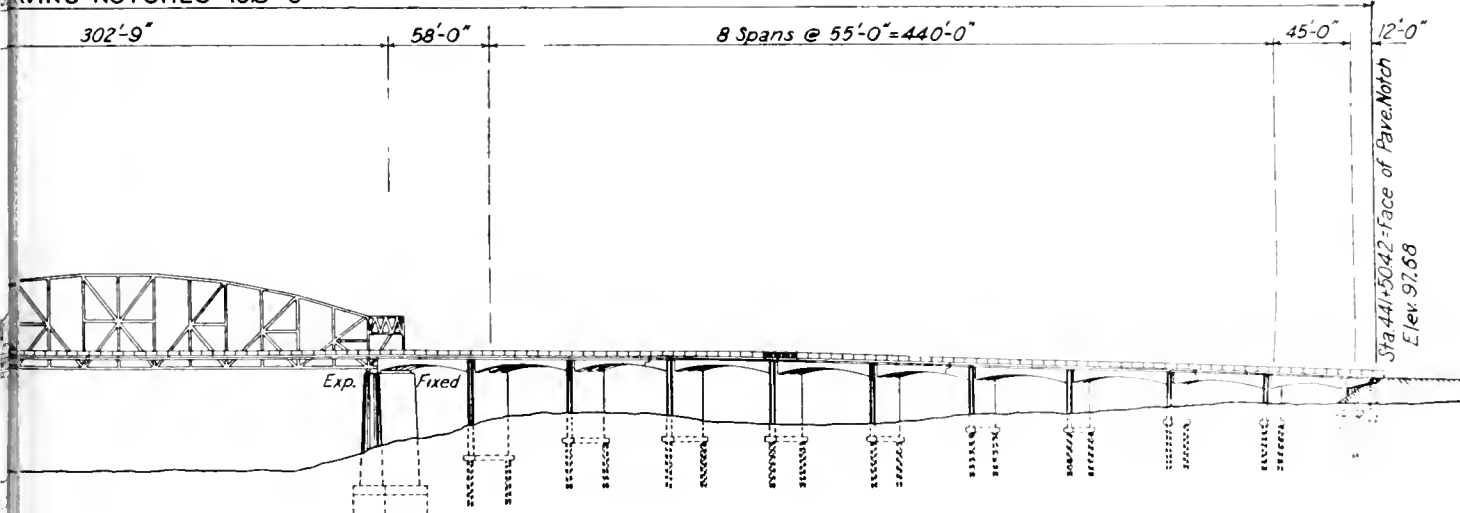
However, Bridge Department hydrologists, after a detailed study of the region, report that the natural phenomena there are capable of startling possibilities. For example, with a simultaneous runoff from all forks of the river, the discharge fore-

cast is the rather large, but not improbable, flow of 370,000 cubic feet per second for one hundred year cycles.

As a measure of flow comparison, the Sacramento River at the Capital City has an estimated maximum discharge at irregular intervals of approximately 100,000 cubic feet per second. Near Needles, California, the unregulated flow (unpublished) of the Colorado River is about 370,000 cubic feet per second at 65-year intervals.

The winding course of the Eel River

AVING NOTCHES = 1613'-0"



has been the arch foe of the motorist and the highway engineer alike by impeding the direct travel of the motorist and by presenting natural obstacles, costly to overcome, to the engineer who has the welfare of the motorist at heart, but whose efforts to help are woefully handicapped by insufficient highway funds.

Throughout the years, the Division of Highways has built and maintained the Redwood Empire Highway as it crosses and recrosses the Eel River and traverses many areas subject to slides. As funds became available, numerous improvements have been effected.

Previous to 1914, the crossing north of Scotia, in Humboldt County, was effected by means of ferrying and fording the river. Subsequent to this, were the county-built steel structures at North Scotia and at Robinson Ferry, one and a half miles north.

flanked by approach spans of concrete, whose footings will be supported on concrete piles. Access is provided to the interior of one of the main piers, where a self-recording water level gauge of the U. S. Geological Survey will be installed.

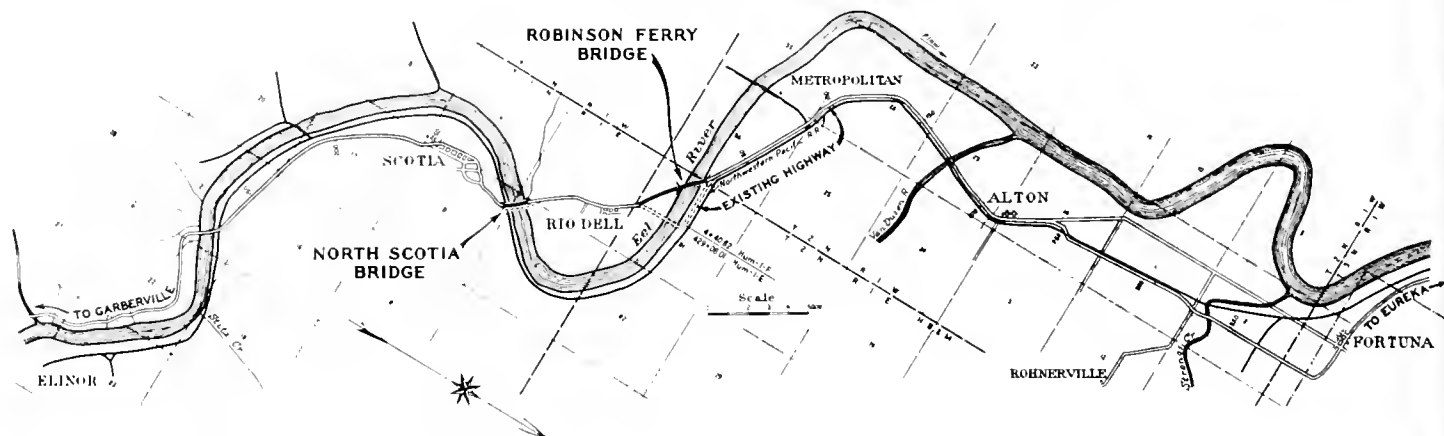
There is a certain similarity of layout in the plans of both bridges but the Robinson Ferry Bridge will be skewed throughout its entire length. Right angle crossings, as studied, revealed that while such a bridge would cost less in itself, the roadway approaches would be longer and introduce undesirable alignment conditions. The skew condition necessitated the use of "simple" type channel spans of steel, one end of each of which is "free" to move a small amount longitudinally. The floor panel lengths of these steel spans are so related as to secure "square" framing. This simplicity feature, and

a minimum amount of material in their make-up—will be so constituted, that their substructures and superstructures mutually interact to sustain loads.

These structures were designed to support the maximum loading permitted by statute. The area in which they are situated has been the origin of numerous earthquakes, but these bridges will shake off earthquakes and laugh at "Ole Man River."

The contractors will be permitted to erect the main spans in the manner they choose, dependent upon their equipment and also upon the river stage at the time of field assembly. The spans are adaptable to erection by cantilevering, or by the use of falsework or a combination of these methods.

A new epoch of structural steel is



Map showing locations of new bridges across Eel River under construction at Scotia and Robinson Ferry on Redwood Highway.

These have long since outlived their usefulness. They have 17-foot roadways and for the past several years have been unreasonably expensive to maintain from the combined standpoint of painting, load and speed restrictions and the full-time employment of three shifts of watchmen on each of the two existing structures to enforce the posted limitations.

Both of the new bridges will have 26-foot roadways, ample for the next 20 years' traffic development in their vicinity. There will be a 4-foot sidewalk on either side of each bridge to accommodate the pedestrian traffic between the communities of Scotia and Rio Dell. The sidewalks on the truss portions will be cantilevered with the outer edges of the walks protected by steel railings of the baluster type.

The North Scotia Bridge will have three channel spans of structural steel,

that obtained by masking the skew in vertical portals, has effectively reduced shop costs.

The river channel at both sites is bedrock overlaid with a shallow cover of gravel and cobbles. The original bridges here and in the vicinity have yielded long-time records which have been invaluable in determining the requirements of the new, as to adequacy of span lengths, foundation behavior, etc.

Due to the existence of developed real estate properties adjoining the bridge ends, it was impossible to raise the new grade sufficient for the adoption of the deck type of steel span.

Aside from the Robinson Ferry steel spans, all parts of both bridges will be of the "continuous" rigid frame type. This means that groups of spans—by the efficient disposal of

at hand, employing alloy steels in a wide variety of uses. With sufficient price competition now procurable for these steels from nation-wide producers, most of the structural steel for these bridges has been selected from the alloy classification.

While this material initially costs more per pound than inferior steels, its adoption was predicated upon such ruling factors as self-liquidation from a corrosion resistant standpoint of less maintenance cost and reduction in dead weight due to its higher stress carrying capacity. Technically, numerous qualities may be enumerated in its behalf and difficulties of shop fabrication are not increased.

All bridge work is under the general direction of F. W. Panhorst, Bridge Engineer. The Designing Engineer of Bridges is L. C. Hollister, to whom the writer is assistant.



Channelized intersection along Lakeshore Avenue, Oakland. Note utilization by traffic of turning lanes and protection for pedestrians.

Highway Intersections at Grade

L. A. WEYMOUTH, Assistant Highway Engineer, Surveys and Plans

IN RECENT years the motoring public has been introduced head-on and otherwise to channelized intersections. The reaction has been varied and not entirely complimentary, if one can believe recent cartoons showing bewildered motorists in a maze of traffic islands and channels. To say that these are entirely without justification would be evading the facts. However, with the aid of past experience and constant research, objections are gradually being overcome and the channelized intersection is more and more proving its worth in the reduction of accidents and congestion.

The fact that approximately one out of every four accidents on rural highways and nearly all the congestion (assuming sufficient width and number of lanes to accommodate maximum traffic) can be attributed directly to intersecting traffic illustrates the importance of the problem. The ideal intersection, of course, would be one with all the various through and turning lanes separated by underpass or overhead structures which

utilize the so-called clover-leaf or braided intersection design. Under these conditions there would be no possible conflict between various traffic movements and each vehicle could pass through on easy flowing alignment without danger of collision or loss of time.

This braided type of intersection involves large expenditures so that its construction can be justified only where large volumes of traffic conflict. Modifications of the braided intersection where only the main traffic streams are separated are more in evidence but these, too, require high traffic volume to justify their cost.

VARIED TYPE INTERSECTIONS

It is unfortunate that the same amount of protection against accidents and loss of time can not be incorporated in all intersections, regardless of the traffic volume. However, all intersections are entitled to consideration, at least commensurate with the traffic volume. In this field comes the varied treatment of intersections at grade which includes the

ordinary open intersections, channelized intersections, signal controlled intersections and various combinations of the above. All have their place in the general scheme and intelligent initial planning can make each type a stage construction which can be readily adapted to a more advanced type as traffic volume warrants and funds become available.

Since the two primary considerations of any intersection design are the safe and expeditious movement of traffic it is important to know the factors which affect these considerations. The three principal factors are the performance characteristics of the vehicle operated on the road, the physical conditions presented at the intersection and the volume and character of traffic for which it is to be designed.

RESEARCH STANDARDS

The American Association of State Highway Officials, with the cooperation of the Federal Public Roads Administration and other interested groups, has made considerable prog-

ress toward the solution of the intersection problem. By correlating the past experiences of the various states and the results of the many separate research ventures, they have taken a large amount of the guesswork out of intersection design and established reasonable standards dependent on performance characteristics of the operated vehicle. Performance characteristics, as used herein, refer to the performance of the operated car in stopping, decelerating, accelerating, turning, etc. Because of the many variations in vehicles it was necessary to establish composite vehicles, called assumed design vehicles, having performance characteristics that would include the majority of vehicles in a particular classification. Only two general classifications, passenger cars and trucks, were considered.

Standards developed by the association include minimum radii for the edge of pavement of 30 feet for passenger cars and 50 feet for trucks. Their centered compound curves fit the path of the vehicle more closely but the refinement is not justified when the interior angle is greater than 90 degrees.

MINIMUM RADII FOR TURNING

The minimum radii developed for turning at various speeds are as follows:

Turning Speed m.p.h.	Minimum Radius Feet
20-----	50
30-----	130
40-----	250
50-----	500

The widths of pavement for separate turning lanes vary with the radius, type of traffic, and number of lanes and relative direction of traffic in the lanes. For instance, the width developed for a single one-way lane varies from 17 feet for a 50-foot turning radius for truck traffic, to 12 feet for a 300-foot turning radius for passenger traffic.

The use of additional lanes for turning traffic to accelerate to the speed of through traffic before moving into the high speed lanes or for moving out of high speed traffic before decelerating to the required turning speed is still a controversial question. However, the association has developed lengths for speed change lanes to satisfy performance characteristics of the assumed design vehicles and has recommended further

research and study by the States before they are finally adopted.

INTERSECTION DESIGN

Other standards dependent on performance characteristics which have been developed or are being evolved include sight distance, alignment and grades, signing, warrants or justification for various types of intersection treatments, etc. All are important and form the fundamentals of intersection design.

The above applies to intersections in general. For a specific intersection design, it is necessary to know, first, the physical characteristic, such as the number of intersecting roads together with their angles of approach and grades and alignment, the general topography or lay of the land, the extent and character of adjacent improvements as affecting land values, and other pertinent information; and second, the traffic data such as present and probable future speeds, type of traffic whether truck or passenger, traffic pattern or periodic variations in flow, existing and probable future traffic density for all turning movements, and accident experience on the existing intersection. Figure 1 illustrates a typical traffic flow diagram.

Physical limitations will often prevent the use of the type of intersection which experience might dictate as best suited for the traffic conditions. In some cases minor traffic movements will have to be penalized to expedite the free and safe flow of the main movements of traffic. In developing the final design to be built into the highway system, the engineers must consider all of the above items together with the important consideration of the amount of funds available.

CHANNELIZED INTERSECTIONS

Although the above is generally applicable to all types of intersections, the balance of this discussion will be limited to channelized intersections.

By confining traffic to definite channels which will bring turning and through traffic to favorable angles of intersection, by providing protecting islands where vehicles may stop between lanes or before entering lanes of through traffic and by separating the various turning movements, channelizations are accomplishing much in the reduction of congestion and accidents. Mr. Guy Kealey aptly states, in a recent paper in the Proceedings

of the American Society of Civil Engineers, that it has not been possible "to educate or force each driver to keep in his own place or channel and keep out of wrong ones because most roadways permit and often invite wrong movements. * * * if proper directional channels are made logical, easy and inviting to use, and if others are made unattractive and difficult, drivers (who, in the main, are surprisingly competent anyway) will follow the lines of least resistance and use the right ones."

Another important benefit of channelized intersections which should not be overlooked, especially in urban areas, is pedestrian protection. The channels make it possible for the pedestrian to confine his attention to traffic in one direction while crossing a lane and the islands give him a protected zone between channels.

SINGLE CHANNELIZATION

Contrary to popular belief, a channelization need not be complicated to be effective. One simple type that has proven quite effective is illustrated in Figure 2. In this case road A is of secondary importance to road B-C. By deflecting traffic from road A to a right angle approach, many accidents of the head-on type caused by entering traffic from A, making a wide left turn against traffic from C, can be eliminated. The short channelizing lane is for left turning traffic from B to A, which for this initial treatment should be of light volume. If the traffic from B to A were so small as to be negligible, the design could be further simplified to a single island by the elimination of the short channel.

The above simple channelization is well adapted to future expansion as traffic conditions warrant, without sacrifice of the initial investment. For instance, one of the first steps in expansion might be the construction of a four-lane divided highway on road B-C. If the islands on road A are properly designed they can be adapted to the new conditions without change by providing proper openings in the division strip (Fig. 3). The short lane within the dividing strip parallel to B-C is a speed change or accelerating lane which should be long enough to allow turning traffic to accelerate to approximately the average speed of traffic along the through road before merging. In this case, left turning traffic from B to A and right turning traffic from A to B

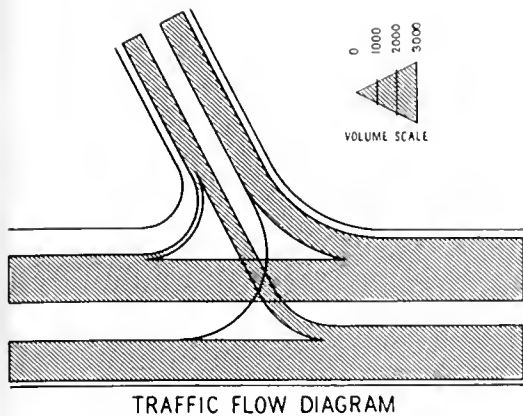


FIG. 1

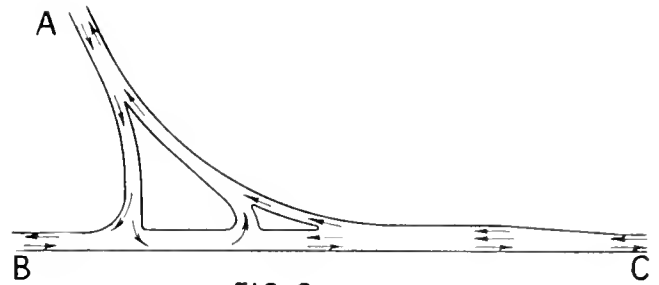


FIG. 2

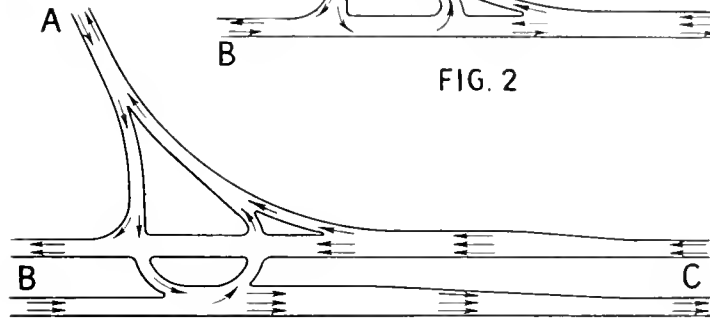


FIG. 3

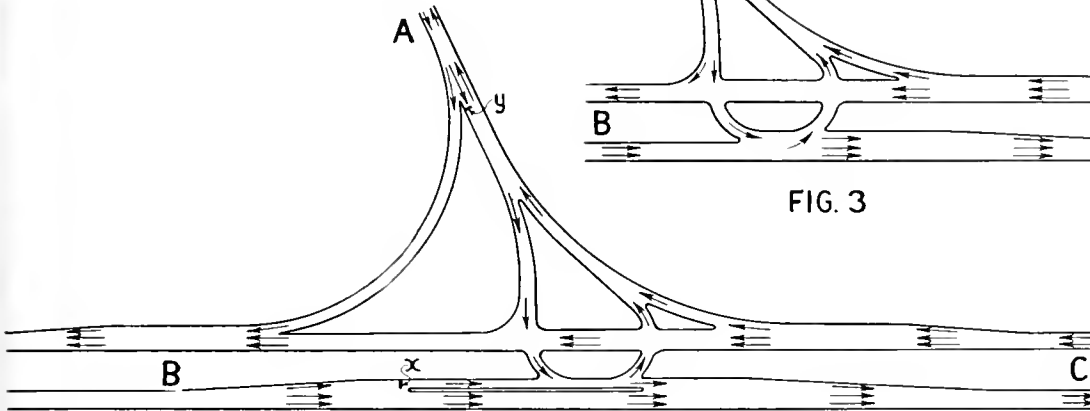


FIG. 4

Illustrating stages in the expansion of the simple "Y" type intersection at grade to keep pace with increasing traffic volume.

is assumed of minor importance not warranting additional expenditures.

DECELERATING LANE

If, on the other hand, there is a considerable interchange of traffic between B and A, more adequate provisions should be provided. This is illustrated in Fig. 4, where a speed change or decelerating lane has been added for protection against rear end collision to vehicles slowing to make the left turn from B to A. Also a separate turning lane has been provided to expedite traffic turning right from A to B and to relieve the intersection proper. This lane should have a radius sufficiently long to permit free flow but should not be great enough to allow traffic to enter C-B at greater than the average speed along C-B. The long narrow island along B-C has a dual purpose in that it assures use of the speed change lanes by left turning traffic and prevents traffic from B to A from making a left turn from the right lane. Thus the possibility of wrong movements has been almost entirely elimi-

nated while the correct movements are easy and natural.

Although the above is about the ultimate in channelization for the particular conditions described, the limit of expansion, without leaving the field of intersections at grade, has not been reached. The engineer still has recourse to traffic signals.

While the use of traffic signals comprises a huge field of study in itself, the full extension of the above type intersection can not be covered without mentioning them here.

This design is particularly adapted to traffic actuated signals which are a comparatively recent development in the intersection field. Simply explained, they consist of treadles so placed in traffic lanes that when passed over or actuated by a vehicle they will set the signal for a predetermined interval so that the vehicle or vehicles may proceed through the intersection while conflicting traffic is stopped. They could be used in conjunction with the channelization shown in Figure 4 when traffic on route B-C becomes so heavy that traf-

fic from B to A and A to C would be unduly delayed waiting for a chance to cross. Initially, treadles could be placed at x or y or both, if required. The intersection is beginning to look complicated but it is not. Traffic from B to C, C to A and A to B can move through with no delay. Traffic from C to B moves through without delay at all times except when the right of way is lost to traffic from B to A or A to C. At first glance it might appear that the last two movements, although they might be light, could rob most of the "GO" interval from the heavier volume of through traffic from C to B. This is not the case because the traffic actuated signal lends itself to adjustment so that the least delay to the greatest volume of traffic results.

Thus the channelization has developed from a simple directional island costing around \$300 to a more elaborate affair with signals at a total cost of several thousand dollars. However, if the initial design is intelligently planned and the steps in expansion are made only as traffic



Channelized "Y" type intersection of Waldo approach highway to Golden Gate Bridge and U. S. 101 to Sausalito in Marin County.

warrants, the taxpayer is getting the maximum returns from his investment.

The foregoing discussion has dealt with only one particular type of intersection because it illustrates what can and is being accomplished. Many different conditions will require as many different types of treatment. Even the simple "Y" type intersection illustrated above requires many variations to fit different angles of approach and varying traffic conditions. As the number of intersecting roads increase, the channelization usually must be expanded to meet the still greater increase in number of turning movements until a point is reached where channelization in itself is no longer the solution. In any case, it is usually possible by proper planning to fit the initial development into the ultimate whether the ultimate be signalization or a grade separation.

Although not a channelization in every sense of the word, the traffic circle or rotary has its place with intersections at grade. The rotary in its simplest form is merely a large circular island around which all traffic travels in the same direction and ingress and egress to the circle is limited to right turns. It is particularly adapted to intersections with four or

more entering roads of nearly equal traffic volume. When properly constructed with sufficient advance warning signs and deflection islands to direct and slow entering traffic, the number of serious accidents at this type of intersection is very low. The reason for this is that the traffic, because of the comparatively small radii of rotaries, must proceed slowly and that all traffic is moving in approximately the same direction. The chief objection which may be brought against it is the loss of time element, as all traffic must slow to a reasonable speed and must travel a greater average distance of approximately 0.57 of the diameter of the circle each trip through. Thus a 180-foot radius circle which could be traveled under favorable conditions at 35 miles per hour would add about 205 feet to the length of each trip.

The principal functional difference between a rotary and an ordinary channelization is that channelization allows free movement of the larger traffic volumes at the expense of the smaller volume whereas a true rotary penalizes all traffic equally but possible to a lesser extent than the minor movements are penalized in the ordinary channelization.

While channelizations are not the solution for all intersection problems, they have proven themselves very effective in the reduction of accidents and congestion when properly applied within the limits of their warranted usage. Much progress has been made toward their perfection but more is both desirable and necessary and will come with further research and experience, especially through traffic behavior studies of existing installations.

Building the Mint Canyon Cut-off

(Continued from page 8)

Surfacing will be of bituminous plant mix and wide oiled shoulders will be provided. The only railroad crossing on the project will be on an overhead bridge over the Southern Pacific Railroad at Solamint. The entire project is being built to high

standards of alignment and grade, with correspondingly high safety features. Sight distance (both vertical and horizontal) has been designed for a minimum of 800 feet. The minimum radius of curvature is 3500 feet.

(Continued on page 26)

Flood Waters Cover 500,000 Acres of Land

(Continued from page 4)

made shore several miles down stream. For this reason, Director of Public Works Clark directed State Engineer Hyatt to engage a plane and to send out boats and to patrol the shores on both sides of the by-pass.

Paget and his companions in a small outboard motor boat were following a line of telephone posts in the by-pass when the prow of the boat hit a post on the north side of the by-pass and capsized. Paget and von Bergen held on to the upright post until their combined weight uprooted it and threw them into the water. McCallum, meantime, had floated downstream and was picked up.

Von Bergen was 34 years of age and had been with the Division of Water Resources since March, 1930. He was married and had a wife and child in Sacramento. The family home is at 3101 Montgomery Way.

It is estimated that the combined maximum flow of the by-pass system and the river opposite Sacramento on March 1st, when the crest was passing, was 355,000 second-feet. This run-off exceeds the estimated flow in December, 1937, which was 262,000 second-feet and the later flood in February, 1938, of 271,000 second-feet.

To give an accurate picture of just what the by-pass system and the river were carrying at that time it is necessary to translate these figures into acre-feet. At the peak flow of 355,000 second-feet, had the system been suddenly dammed below Sacramento, the waters would have spread two feet deep over 355,000 acres in twenty-four hours.

IN BY-PASS SYSTEM

Below Sacramento, Prospect and Liberty Islands lying in the Yolo By-pass and over which the State has flowage rights were flooded when the water rose over the low tidal levees with which they are protected. The Little Holland Tract in the by-pass which is unprotected also flooded as did the Egbert Tract, Van Sickle Island and Upper Hastings. These areas, while subject to flooding in times of extreme high water, are ordi-

Traffic on the Bay Bridge Last Month Exceeded February, 1939

VEHICULAR traffic on the San Francisco-Oakland Bay Bridge was again ahead of that of February a year ago, Director of Public Works Frank W. Clark reported to Governor Culbert L. Olson.

A total of 842,070 vehicles crossed the bridge last month, of which only 13,741 stopped at Treasure Island, leaving a net through bridge traffic of 828,329. In February, 1939, the comparable figures were 753,687 with 146,317 vehicles going to Treasure Island, making the net through traffic 607,370. The 29th day this February helped regular bridge traffic somewhat, while the opening of the exposition on February 18, 1939, had its effect last year.

A year ago the average toll was 51.9 cents, producing a revenue of \$390,807 while this year the average toll is down to 36.8 cents with a revenue of \$309,669.

Passenger autos and auto trailers----	767,371	673,134	772,440	29,212,099
Motorcycles and tricars-----	2,699	2,869	2,471	134,872
Buses -----	15,380	12,445	16,469	472,801
Trucks and Truck Trailers-----	40,984	46,832	41,798	1,401,831
Others -----	15,636	18,407	16,732	494,998
Total vehicles -----	842,070	753,687	849,910	31,716,601

narily farmed and produce large crops of asparagus and sugar beets.

Flash floods on Cache Creek and Putah Creek damaged grain crops and sugar beet lands and drove 250 migrants from a Farm Security Administration Camp along Putah Creek near Winters. The water here came up so quickly during the night the migrants were forced to flee without even their scant belongings and were housed at the State Fair grounds in Sacramento, where they were cared for by the National Guard and the Red Cross. These flash flood waters quickly receded.

The Napa River had the heaviest overflow in 27 years, flooding areas from St. Helena to the bay. In many sections of Napa the water was four feet deep. Schools were closed and the city isolated. Thousands of acres of rich vineyard and orchard land between these two cities were under water and a lake that covered ten square miles lay south of Napa.

"On February 29," Clark reported, "the bridge deposited \$1,666,500 to meet its semiannual interest payment of \$1,406,500 and to pay off \$260,000 of bonds that fell due. There remained \$70,065,000 of bonds outstanding. The financial position of the structure is excellent and the market value of the bonds generally stands at about 109."

The heavy storms of February did not leave the bridge entirely unscathed. One leg of the Distribution Structure in the East Bay was closed by high water for almost a day and on two of the other legs traffic was handled under control for many hours. On Yerba Buena Island sand and debris was washed onto the lower deck, blocking drains and backing up water so that this deck had to be closed to traffic for several hours. February traffic and comparative figures are:

The Russian River, swollen by heavy rains, burst its banks, causing heavy damage to summer homes and resorts which line its edge for many miles. Farther north along the coast the chief damage reported was to highways.

In Berkeley a freak clondburst caused an estimated damage of \$100,000 within ten minutes. High tides and heavy rains combined to block Key System electric trains across the San Francisco-Oakland Bay Bridge. South of the bay district in Santa Cruz many homes in the lower section of the city were surrounded by overflow from the San Lorenzo River. Residents in low-lying areas were rescued in row boats.

As the storm passed and the flood waters receded several pertinent facts became evident.

The Sacramento River Flood Control Project proved itself effective and functioned as designed in han-

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Portion of Funston Avenue approach to Golden Gate Bridge under construction through San Francisco Presidio looking toward 1300-foot tunnel.

Golden Gate Bridge Approach Construction Nears Completion

By JNO. H. SKEGGS, District Engineer

BEGUN in October, 1938, the Funston Avenue approach, extending from the intersection of Lake Street and Park Presidio Boulevard on the south side of the Presidio of San Francisco to the Marina approach to the Golden Gate Bridge, is rapidly nearing completion. Depending on weather conditions, it is tentatively scheduled for opening to public traffic about April 15, 1940.

Unique features and financing of the project were detailed in the June, 1939, issue of "California Highways and Public Works."

Although hampered somewhat by inclement weather during the latter part of 1939 and the early part of this year, progress has otherwise been very satisfactory.

Due to the necessity of completing various portions of the project before subsequent operations could be started, adherence to planned schedules for coordinating all construction operations was imperative, keeping in

mind the speed with which the various contracts could be economically performed and the earliest possible date for opening the project to public travel.

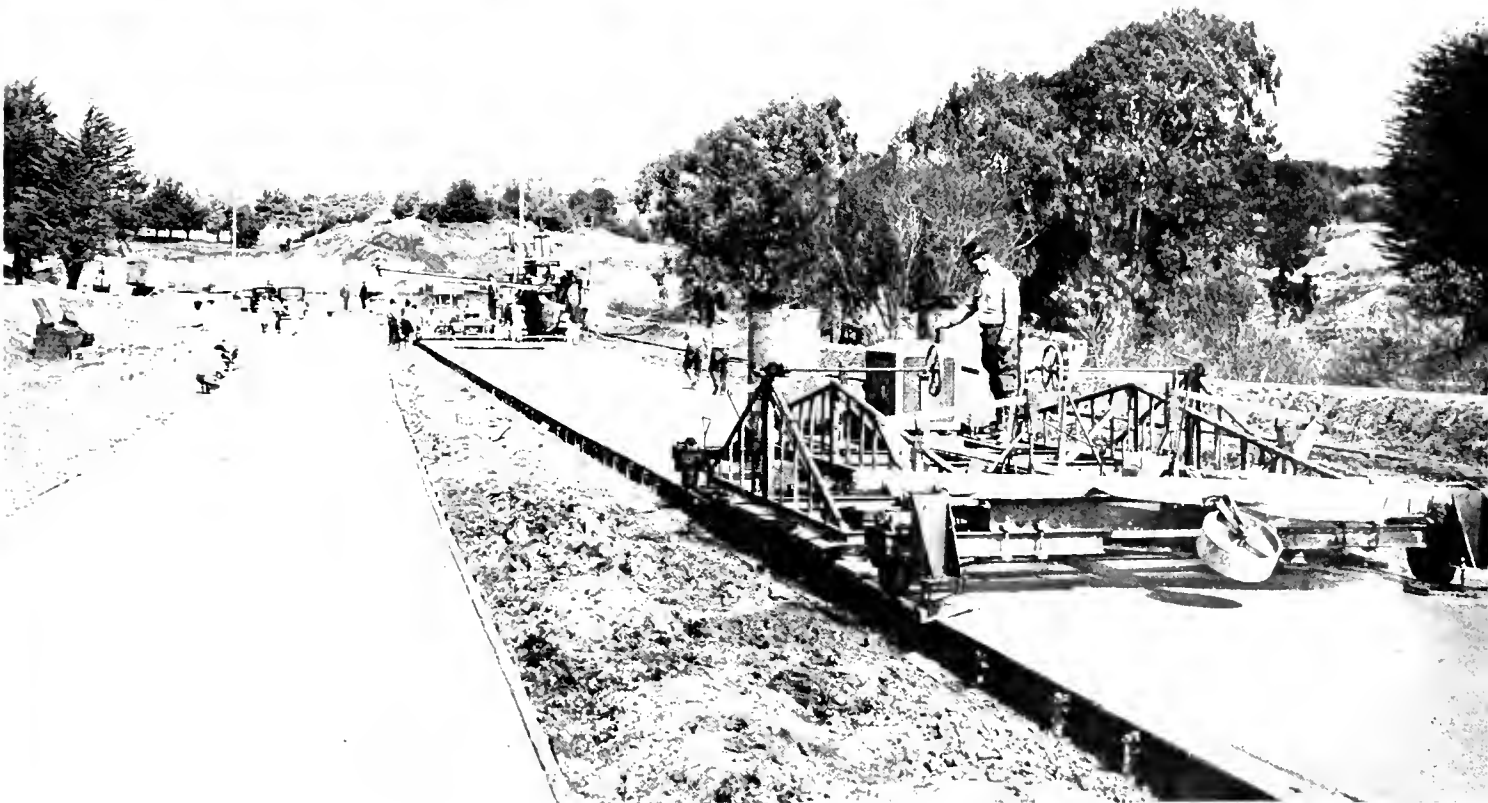
Completion of the contract for grading, and the construction of the 1300-foot, 4-lane cut and cover tunnel section extending under the Presidio golf course, was accomplished without material delay in January, 1940.

Two sections of steel form jumbos, which had been formerly used on the construction of the Bartlett Multiple-arch dam in Arizona, traveling on standard railroad rails, were used in constructing the tunnel arch. Each section above the spring line, consisting of twenty-eight lineal feet between expansion joints, was constructed in one continuous pour of concrete. Alternate pours at each jumbo placed at opposite ends of the tunnel made it possible to complete from two to three sections per week. Copper strips at each expansion joint were placed

to prevent seepage of water into the tunnel.

Tunnel excavation was used to construct the embankment across Mountain Lake, excess material acting as a surcharge to displace soft underlying mud. Upon completion of the concrete tunnel section this surcharge was removed and placed as backfill over the tunnel section to the approximate original ground levels, permitting golf-course facilities to be replaced to their original state.

Construction of the viaducts, all rigid frame, continuous girder type structures, was carried on simultaneously with the tunnel and grading operations, being, however, under separate contracts. Construction was carried on continuously, forms and falsework being cleaned, oiled and used on succeeding work. Progress of pouring and curing of concrete in girders and deck made it possible to use again the timbers and forms, without the necessity of obtaining



At top—Completed south approach walls and portal of cut and cover tunnel under Presidio golf course. Adjacent slope areas to be planted with trees and shrubs. At bottom—Mechanical finishing float and paver at work surfacing 4-lane divided highway.

sufficient material to complete the structures simultaneously.

Construction of Viaducts "A," "B" and "C," over West Pacific Avenue, Kobbé Avenue, and Storey Street, respectively, all Presidio post roads, was accomplished under a single contract which was completed on December 22, 1939.

Viaduct "F," having a centerline radius of 299 feet and a height of 70 feet above the ground, provides a connection to the Golden Gate Bridge approach for traffic from San Francisco's Richmond District to the Marina District. This viaduct was designed for curved beams and was completed under separate contract on November 30, although the same contractor was the low bidder on both viaduct contracts. All viaducts on the project were, therefore, constructed by the same contractor.

In order to provide a means for traffic to have rapid access to the Richmond from the Marina District, it was necessary to construct a ramp from the north side of the Golden Gate Bridge approach, and construct an underpass across the approach.

During the construction of the underpass, it was necessary to close the southern half of the Golden Gate Bridge approach for approximately 150 feet, southbound traffic being diverted to the north lanes of the approach, and northbound traffic being detoured north of the approach for a distance of approximately two hundred feet.

Upon completion of the southerly end of the underpass, southbound traffic was permitted to assume its regular lanes, northbound traffic using the constructed detour until the north portion of the underpass was com-

pleted. No delay and little inconvenience was encountered while the detour was in use.

Included in the same contract for construction of the underpass were the approach walls, pedestrian underpasses accommodating pedestrian traffic of the Golden Gate Bridge, and drainage facilities connecting to the main system for the project. Final work on the contract was done on February 21, 1940.

As explained under previous articles on the project, all drainage within the limits of the project is disposed of by means of master drains terminating in the bay at the northerly end of the job, and into Mountain Lake on the southerly end. No drainage originating within the limits of the work is disposed of upon adjacent Presidio property.

Nearly simultaneous completion of the viaducts and tunnel and grading operations made it possible to begin paving and landscaping operations at about the same time.

Placing of crusher run base, concrete paving, curbs and gutters, electrical conduit and electrical fixtures for signs and lighting were included under one contract, which is still in progress.

Landscaping and beautifying of areas adjacent to the traveled way was covered under separate contract, which is still in process of execution.

A Rex 27-E paver in use on concrete pavement is augmented by an adjustable width Ord tamping machine and a Johnson finishing float, designed by an engineer of the Division of Highways. The newly developed float has proven its value on other paving contracts, in obtaining the desired finish and smoothness

required by the Department of Public Works.

Owing to the fact that the project is a freeway, with the exception of two minor approaches for official use of the United States Army, openings are to be left in the curbs at convenient intervals and locations for access to emergency parking areas that are to be maintained within the shoulder area. Portions of the shoulder between the parking areas are to be planted with shrubs.

Noteworthy is the commendable cooperation by the United States Army authorities, the PWA Regional Director and the Resident Engineer for the PWA, in assisting the Division of Highways.

Construction consisted of six major contracts performed by:

Maceo Construction Co. Grading and tunnel construction. 1 contract.

Union Paving Co. Viaducts "A," "B," "C" and "F" and paving, lighting and signs. 3 contracts.

M. J. Lynch. Highway Underpass and 2 pedestrian underpasses. 1 contract.

Leonard C. Coats. Landscaping. 1 contract.

Supervision of the project was under the direct control of T. E. Ferneau, Resident Engineer for the Division of Highways, and F. W. Moore, Resident Engineer Inspector for the Public Works Administration.

Accompanying pictures of the project indicate the progress that has been made during the period of construction to the middle of February, 1940.

Realignment of U. S. 40 Between Sacramento and Dixon

(Continued from page 13)

which will enter and leave the new road here when using the present road leading to Woodland and up the west side of the Sacramento Valley.

The Southern Pacific Company's double track main line is crossed by this new location about 0.5 mile southwest of the existing subway at Davis. In anticipation of the construction of a divided four-lane subway here, funds being available from the Federal Aid Grade Separation Program, the present project includes the construction, adjacent to the railroad, of

a grade to accommodate the two tracks of the railroad on a "shoofly" which will carry trains past the subway during the construction of the supports under the present tracks. The material for the "shoofly" will be obtained from the portion of the subway included in the grading contract.

Funds are also set up for the construction of three bridges; one over the South Fork of Putah Creek, which carries the bulk of the run-off of the drainage area; the other two will be

parallel adjacent structures over Putah Creek, to meet the divided highway construction planned.

No paving is included in the funds set up in the present biennium, but it is hoped that money will be available in the next biennium to pave this important improvement.

A number of other projects completed during recent years are part of a planned program to bring this important road up to a standard commensurate with its importance.

(Continued on page 28)

Administrative Problems of State Highway Maintenance

By T. H. DENNIS, Maintenance Engineer

This is the third and concluding installment of an address delivered by Mr. Dennis at the meeting of the State-wide Highway Committee of the California State Chamber of Commerce at the Palace Hotel in San Francisco.

THE collection of detail for the maintenance budget is given careful attention by the entire supervisory organization. Its preparation requires at least six months. In common with other State budgets, it is prepared some eight months in advance of its effective date. Each District Engineer is contacted who, through the District Maintenance Engineer and Superintendents, reviews each section of road. Estimates are prepared not only for the routine work, but also for such items as seal coats, restoring of base and innumerable similar items which must be taken care of during the ensuing two-year period. The District Engineers' recommendations are assembled and reviewed in Central Office. If doubt exists as to necessity for any work recommended, a field inspection is made.

THE MAINTENANCE BUDGET

Table 9 sets forth the respective items and amounts which make up the present Biennium Maintenance Budget. The relative percentage to the total is also shown.

There is shown below, for comparison, detail of the maintenance budget for the current and past bienniums:

TABLE 10

Comparison of Budgets

	89th-90th Fiscal Yrs.	91st-92nd Fiscal Yrs.	Per Cent Increase Decrease
General Maintenance	\$9,818,472	\$10,422,601	6.2
Major Slides and Storm Damage	1,705,910	2,020,850	18.5
Replacement	2,486,191	3,402,160	36.8
Improvement	1,637,702	2,105,469	28.6
Service	351,725	197,050	44.0
Capital Investment			
	\$16,000,000*	\$18,148,130	13.4

*This amount does not include supplemental funds voted to care for extraordinary storm damage of 1937-38 winter season.

It is noted that the net increase in the budget for the current biennium is 13.4 per cent, as compared to the amount provided for the previous period. The increases may be accounted for, in part, by three major items:

TABLE 9
Summary of Biennium Maintenance Budget for 91st and 92d Fiscal Years
July 1, 1939, to June 30, 1941

		Amount	Per Cent	Per Mile Per Year
1. General Maintenance		\$10,422,601	57.43%	\$413
2. Major Slide Removal		2,020,850	11.14%	80
3. Replacement & Improved Service				135
(a) Replacement Projects				
Renew Dust Oil (T. W.)	\$141,165—0.78%			
Renew Dust Oil (Shldrs.)	31,300—0.17%			
Remix Oil Surface (T. W.)	923,543—5.09%			
Remix Oil Surface (Shldrs.)	346,906—1.91%			
Oil Sealing (T. W.)	629,506—3.47%			
Oil Sealing (Shldrs.)	101,540—0.56%			
Restore Sub-base (T. W.)	429,800—2.37%			
Restore Sub-base (Shldrs.)	81,250—0.45%			
Bridge Painting	201,555—1.11%			
Bridge Repairs	515,595—2.84%			
		3,402,160	18.75%	83
(b) Improved Service Projects				
Guard Rail Installation	54,100—0.30%			
Guard Rail Repairs	18,025—0.10%			
Weed Eradication	246,800—1.36%			
Traffic Striping	494,453—2.72%			
Signs & Signals	88,558—0.49%			
Snow Removal	1,033,462—5.70%			
Sanding Icy Pav'ts.	98,371—0.54%			
Planning & Discing Surface	21,600—0.12%			
Non-skid Surfacing	27,300—0.15%			
Sodium Vapor Lights	22,800—0.13%			
		2,105,469	11.60%	
4. Capital Investment		197,050	1.08%	8
Total		\$18,148,130		\$719*

* (or \$711 excluding the Capital Investment)

biennium is 13.4 per cent, as compared to the amount provided for the previous period. The increases may be accounted for, in part, by three major items:

1. Increase in wages ----- \$754,000
2. Increase to cover deferred storm damage from previous biennium ----- 300,000
3. Increase to take care of replacement work deferred in 1938 due to necessary transfer of all available funds to emergency storm damage repair.

Items 1 and 2 account for some 50 per cent of the increase. It is

difficult to estimate exactly the increase due to the deferment shown under Item 3, though it is reasonable to presume a part of the \$1,000,000 increase in such items as remixing and sealing oil surface, both traveled way and shoulders, restoration of subbase and repair of bridges was occasioned thereby.

In the above comparison, the General Maintenance item is some 6 per cent greater than that of the past period. The increase in labor cost, however, more than absorbs this difference so that actually work per-

formed during this period will be somewhat less than in the previous two years. There are several items in the above costs which unduly affect the per mile cost of maintenance. A few of these items are listed below:

	Biennial Requirements
Operation of 23 movable span bridges	\$200,000
Operation of two ferries.....	20,000
Operation and lighting of State's portion of Broadway Low Level Tunnel on Route 75	28,000
Lighting of Bay Shore Highway	16,000
Lighting of section of Waldo Approach	13,000
Funds required to supplement 1 cent funds for upkeep of State highway routes in incorporated cities where 1 cent funds are inadequate.....	86,000
	\$363,000

The above amount, if available for routine maintenance alone, would provide for the annual care of some 450 miles of highway.

REPLACEMENT PROJECTS

Replacement projects, which represent 18.75 per cent of the total maintenance program, cover the renewal and sealing of oiled surfaces—both traveled way and shoulders—the restoration of subbase, as well as bridge repairs and painting. This work forestalls heavier expenditures which would be required for earlier reconstruction, but it is evident that such expenditures will increase in proportion to the delay in programming this needed reconstruction. This replacement or repair program insures the motorist of the continuing use of what, in many cases, are substandard facilities.

Improved service projects, which

amount to 11.6 per cent of the total budget, include guard rail installation and repairs, weed eradication, traffic striping, signs and signals, snow removal, sanding icy pavements, disking and nonskidding surface. The major items of this type include snow removal, traffic striping and weed eradication. These are purely service projects, and their growth is indicative of the pressure made for their expansion. Snow is removed on 3500 miles of road, 15 per cent of which is for snow sports almost exclusively. The cost of snow removal on this 15 per cent is ten times the fuel tax revenue earned from the induced traffic.

TRAFFIC STRIPING

Traffic striping is one of the most worthwhile safety measures. The demand and the necessity for this type of work are increasing. In the past, it has been our practice to repaint most of the stripe once each year. This program no longer suffices, and it has been necessary to paint more often over a larger mileage, and to paint double and triple stripes.

The control of roadside vegetation is sponsored and advocated by many organizations. It is of benefit to adjoining property as protection from fires which may be started by highway traffic.

Provision for Major Slide Removal shows an increase of 18.4 per cent over that of the 89th-90th fiscal years. Actually, the increase is required for the restoration of certain mountain routes in the southern part of the State on which it was necessary to defer work last biennium due to lack of funds. The funds required for slide removal will, of course, vary with the sever-

ity of the winter. Recently, an unprecedented storm in Imperial and Riverside counties caused damage which would require in excess of \$400,000 if complete restoration and protection were assured.

In the last analysis, the measure of service is the relation between cost and service rendered. Income for highway purposes is dependent on operation of motor vehicles. The measurement of service can therefore be made on the same basis. As mentioned in a preceding paragraph, 6,825,000,000 vehicle miles of travel are generated on the California rural State highway system. The cost of maintaining the roads for this traffic last year averaged 12.6 cents for every 100 miles of travel. A comparison has been made with similar service for the five Western States as shown in Table 11. It is noted that, as compared to California, the cost per vehicle mile varied from 1.45 times to 2.75 times greater for the four neighboring states.

Building the Mint Canyon Cut-off

(Continued from page 20)

The final contract was awarded September 8, 1939, and the time limit for completion is September 20, 1940. However, the contractor (N. M. Ball Sons) have made exceptionally rapid progress and it is now estimated by Resident Engineer M. L. Bauders that work will be completed some time during July.

The entire project from Tunnel Station to Solamint is 7.13 miles in length and the approximate cost will be \$836,000. The saving of 5.2 miles to motorists will be sufficient to pay for the entire project in four years based on present traffic.

TABLE 11
Comparison of Maintenance Costs and Traffic on State Highways of Five Western States

	Miles Maintained	Amount of One Year Expenditures	Average cost per Mile	Annual Veh. Miles of Travel	Relative Cost of Maintenance Expressed in Cost and Per Cent by Vehicle Miles of Travel	
					%	Cost per vehicle mile
Arizona	3,460	\$1,168,310	\$338	635,070,800	145	\$0.001839
California	12,622	8,618,178*	683	6,825,000,000	100	.001263
Nevada	2,806	831,000	197	239,653,000	275	.003468
Oregon	6,828	3,383,197	495	1,501,630,000	178	.002253
Washington	5,916	3,736,000	632	1,500,000,000	197	.002490

* This is the amount spent on rural State Highways only.

Highway Damage Totals \$1,267,200

(Continued from page 7)

The above is not a complete list of all closed routes, but is indicative of the general extent.

Bridge Damage

Aside from the delays and inconvenience to traffic, the direct damage is estimated as follows:

Bridges destroyed or damaged	\$192,000
Fills washed or slipped out	489,000
Slides	586,200
Total	\$1,267,200

Some of the major items of damage may be mentioned:

Redwood Highway—U. S. 101.

1. Failure of north approach span across Eel River at Scotia.
2. Slipouts at Greenlaw and Shively Bluffs.
3. Slipout two miles north of Cloverdale.
4. Slides at Waldo approach.

Bayshore Highway—U. S. 101

By-Pass.

5. Slide at Brisbane.



Huge rock slide on Feather River Highway east of Oroville blocked traffic.

6. Bulkhead failure at Francisquito Creek.

Russian River, State Sign Route 12.

7. Slides and slipouts, Guerneville to Monte Rio.

Tahoe-Ukiah, State Sign Route 20.

8. Washout at Cache Creek.

Pacific Highway, U. S. 99.

9. Damage to bridge north of Redding.

Feather River Highway, State Sign Route 24.

10. Severely damaged by washouts and slides at several points from west of the Butte-Plumas County line to east of Quincy.

Flood Waters Cover 500,000 Acres of Land

(Continued from page 21)

dling flood waters. In the project the only levees broken north of Princeton and in District 1660 and 70 were those not up to standards and are among those which the War Department has scheduled for reconstruction.

It was also evident that had the Shasta Dam unit of the Central Valley Project been completed it would have served as an effective check on a flood of this type, as shown by stream flow figures already available. Provision has been made at Shasta Dam for storage space for 500,000 acre-feet of water for flood control purposes. However, engineers point out that at this time of year there might have been storage space for as much as a million acre-feet of flood waters. With this amount of storage

available the crest of the flood could have been held back and effectively checked.

Comparison of figures on the flow at Kennett and at Red Bluff in the 1937 flood and the present storm reveal a much heavier run-off in the watershed above Kennett this year. During the 1937 peak run-off, the flow at Kennett was estimated at 132,000 second-feet and at Red Bluff at 262,000 second-feet. Thus approximately half of the flow of the river or 130,000 second-feet originated between Kennett and Red Bluff.

In the present storm, in which the river reached the highest mark ever recorded by the weather bureau gauge at Kennett, the flow was esti-

mated at 182,000 second-feet and at Red Bluff at 292,000 second-feet, showing that the major portion of the run-off originated above Shasta Dam site and consequently could have been held in check.

The Emergency Council met on March 5 and ordered a survey of damage in the flooded areas. Members of the Council are: Finance Director John R. Richards, Public Works Director Frank Clark, Adjutant General P. J. H. Farrell, Dr. Walter F. Dickie, Chief E. Raymond Cato, Highway Patrol; Fred M. Carlson, Robert Beauchamp, American Legion; H. J. McCurry, Red Cross and Kerman Robson, San Francisco.

Highway Bids and Awards for the Month of February, 1940

ALAMEDA COUNTY—At Arroyo del Valle, about 2 miles south of Livermore, a reinforced concrete bridge having an overall length of 246 feet to be constructed and about 0.6 mile of approaches to be graded and surfaced with gravel and armor coat. District IV, Route 108, Section A. Earl W. Heple, San Jose, \$44,092; Scheumann & Johnson, Eureka, \$47,752; Piombo Bros. & Co., San Francisco, \$47,777; Harold Smith, St. Helena, \$49,197; M. J. B. Construction Co., Stockton, \$49,534; E. E. Smith & N. M. Ball Sons, Berkeley, \$49,563; A. Teichert & Son, Inc., Sacramento, \$49,913; John Rocca, San Rafael, \$51,578; A. Soda & Son, Oakland, \$52,154; Trewitt-Shields & Fisher, Fresno, \$54,859; L. D. Tonn, Lodi, \$55,993; A. G. Ruisch, San Francisco, \$56,239; B. H. Miles, Hollister, \$58,598; R. G. Clifford, San Francisco, \$60,345; M. J. Lynch, San Francisco, \$61,678. Contract awarded to Caputo & Keeble, San Jose, \$43,463.

CONTRA COSTA COUNTY—About 23 miles west of Stockton at drainage canals, a reinforced concrete box culvert and two reinforced concrete slab bridges to be constructed and an embankment and approaches to be graded and surfaced. District IV, Route 75, Section D. E. E. Smith, Eureka, \$18,733; John Rocca, San Rafael, \$20,371; Caputo & Keeble, San Jose, \$20,677; A. A. Tieshan, Berkeley, \$21,249; A. Soda & Son, Oakland, \$21,493; Albert H. Siemer and John Carcano, San Anselmo, \$22,970; M. J. B. Construction Co., Stockton, \$24,865. Contract awarded to Harold Smith, St. Helena, \$18,043.

HUMBOLDT COUNTY—Across Eel River at Robinson Ferry, a bridge consisting of steel truss spans and reinforced concrete approach spans to be constructed and about 0.07 mile of roadway to be graded. District I, Route 1, Section E. John Rocca, San Rafael, \$461,555; R. G. Clifford, San Francisco, \$472,278; A. Soda & Son, Oakland, \$474,363; United Concrete Pipe Corp. & Mercer Fraser Co., Eureka, \$478,630; Heafey-Moore Co., Frederickson & Watson Construction Co., Oakland, \$478,889; C. W. Calotti & Co., San Rafael, \$491,568; W. A. Bechtel Co., San Francisco, \$521,118; Guy F. Atkinson Co., San Francisco, \$523,126; Maceo Construction Co., Clearwater, \$548,724; Sordal & Bishop, Long Beach, \$557,326; Hanrahan-Connolly Co., San Francisco, \$558,399; J. H. Pomeroy & Co., Inc., San Francisco, \$568,270; Geo. Pollock Co., Sacramento, \$593,194. Contract awarded to Engineers, Ltd., San Francisco, \$455,580.

HUMBOLDT COUNTY—Across Eel River at Scotia, a bridge consisting of steel truss spans and reinforced concrete approach spans to be constructed, and about 0.24 mile of roadway to be graded. District I, Route 1, Section E. Engineers, Ltd., Sacramento, \$334,203; R. G. Clifford, San Francisco, \$335,763; Campbell Construction Co., Sacramento, \$343,415; John Rocca, San Rafael, \$344,555; Heafey-Moore Co., Frederickson & Watson Construction Co., Oakland, \$347,156; United Concrete Pipe Corp. & Mercer Fraser Co., Eureka, \$349,743; C. W. Calotti & Co., San Rafael, \$359,183; Barrett & Help, San Francisco, \$371,225. Contract awarded to A. Soda & Son, Oakland, \$329,989.

INYO COUNTY—Between Olancha & Cottonwood Creek, about 9.0 miles to be graded and surfaced with plant-mixed surfacing. District IX, Route 23, Sections L.I. Claude C. Wood and Frank B. Marks & Sons, Lodi, \$87,895; G. W. Ellis, North Hollywood, \$91,191; Griffith Co., Los Angeles, \$91,244; Piazza & Huntley, San

Jose, \$95,520; Isbell Construction Co., Reno, Nevada, \$96,458; Oswald Bros., Los Angeles, \$98,705; Parish Bros., Hollywood, \$106,294. Contract awarded to Basich Bros., Torrance, \$78,765.

KERN COUNTY—Across Tule Canal, 29 miles west of Bakersfield, a reinforced concrete slab bridge to be constructed. District VI, Route 58, Section J. C. C. Gildersleeve, Berkeley, \$5,998; John Jurkovich, Fresno, \$6,078; Thomas Construction Co., Burbank, \$6,261; Rexroth and Rexroth, Bakersfield, \$6,302; E. G. Perham, Los Angeles, \$6,404; Griffith Co., Los Angeles, \$6,596; Albert E. Mangs & Associates, San Francisco, \$6,962; Louis Biasotti & Son, Stockton, \$7,614. Contract awarded to James E. Anderson, Visalia, \$5,481.

KINGS AND TULARE COUNTIES—Two reinforced concrete slab bridges across branches of Cross Creek and one timber bridge with concrete deck across Tule River to be constructed. District VI, Route 135, Sections B.A. A. Frederick Anderson, Oakland, \$23,564; Trewitt-Shields & Fisher, Fresno, \$23,956; E. G. Perham, Los Angeles, \$34,553; John Rocca, San Rafael, \$35,586; Rexroth & Rexroth, Bakersfield, \$35,989; Albert H. Siemer and John Carcano, San Anselmo, \$36,484; E. E. Smith, Eureka, \$36,747; A. Soda and Son, Oakland, \$37,648. Contract awarded to L. D. Tonn, Lodi, \$33,220.

LASSEN COUNTY—Between Lake Leavitt and Rager's Corner about 5.9 miles to be graded; portions to be surfaced with road-mix surfacing; and penetration oil treatment to be applied to other portions. District II, Route 73, Section A. Dodge Construction, Inc., Fallon, Nevada, \$30,798; Harms Bros., Sacramento, \$31,604; Oilfields Trucking Co., Bakersfield, \$32,358; Claude C. Wood, Lodi, \$32,497; Parish Bros., Hollywood, \$32,630; Lee J. Immel, Berkeley, \$37,433; Poulos & McEwen, Sacramento, \$37,920. Contract awarded to Isbell Construction Co., Reno, Nevada, \$29,999.

LOS ANGELES COUNTY—The superstructure of an underground crossing under the tracks of the A. T. & S. F. Ry. Co. and the F. P. R. Co. and over the Arroyo Seco and Arroyo Seco Parkway near Avenue 35, consisting of steel track spans. District VII, Route 205, L.A. Bethlehem Steel Co., Los Angeles, \$122,740; Consolidated Steel Corp., Ltd., Los Angeles, \$126,494. Contract awarded to Columbia Steel Co., Los Angeles, \$118,695.05.

MADERA-MERCED COUNTIES—Between one-half mile north of Ash Slough and Dutchman Creek about 4.4 miles to be graded, surfaced with road mixed and plant mixed surfacing and a reinforced concrete bridge to be constructed. District X, Route 4, Sections C.A. Valley Construction Co., San Jose, \$79,604; M. J. B. Construction Co., Stockton, \$82,419; Louis Biasotti & Son, Stockton, \$82,722; A. S. Vinnell Co., Alhambra, \$84,150; Trewitt-Shields & Fisher and Stewart & Nuss, Inc., Fresno, \$84,480; Marshall S. Hanrahan, Merced, \$87,283; Daley Corp., San Diego, \$89,679; Piazza & Huntley, San Jose, \$90,599; Claude C. Wood, Lodi, \$90,791. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$75,963.

RIVERSIDE AND SAN BERNARDINO COUNTIES—Between the county line and Santa Ana River bridge, traffic islands and separation strips to be constructed. District VIII, Route 43, Sections C-F. George Herz & Co., San Bernardino, \$2,965; Matich Bros., Elsinore, \$2,708; Edward Green, Los

Angeles, \$2,310. Contract awarded to A. L. Gabrielson, Arlington, \$2,260.

SACRAMENTO COUNTY—Between Emmaton and Freeport, about 1.5 miles riprap slope protection to be constructed. District X, Routes 11 and 33, Sections DEFC, A 1 St. Hutchinson Co., Oakland, \$32,583. Contract awarded to Basalt Rock Co., Inc., Napa, \$31,166.78.

SAN BERNARDINO COUNTY—Near Cajon Station, about 0.3 mile approaches to two bridges to be graded and surfaced with plant-mixed surfacing. District VIII, Route 31, Section B. A. S. Vinnell Co., Alhambra, \$7,652; W. E. Hall Co., Alhambra, \$7,808; Matich Bros., Elsinore, \$7,816. Contract awarded to Geo. Herz & Co., San Bernardino, \$7,234.90.

SAN BERNARDINO COUNTY—Between Mount Anderson and Crestline, about 1.2 miles to be graded and road-mix surface treatment applied. District VIII, Route 188, Section A. Claude Fisher Co., Ltd., Los Angeles, \$58,412; Geo. Herz & Co., San Bernardino, \$59,871; Rexroth & Rexroth, Bakersfield, \$64,931; Daley Corp., San Diego, \$65,494; Denni Investment Corp., Wilmington, \$65,528; A. S. Vinnell Co., Alhambra, \$69,216; W. E. Hall Co., Alhambra, \$73,826; Dimmitt & Taylor, Los Angeles, \$73,990. Contract awarded to Matich Bros., Elsinore, \$57,210.

STANISLAUS COUNTY—Grade 0.3 mile and pave with Portland cement concrete and asphalt concrete at south approach to Turlock overhead. District X, Route 4, Section A. M. J. B. Construction Co., Stockton, \$14,548; S. M. McGaw, Stockton, \$14,143. Contract awarded to Union Paving Co., San Francisco, \$12,345.

TEHAMA COUNTY—On Sand Slough Bridge, about 1 mile east of Red Bluff, portions of existing bridge to be removed; reinforced concrete curbs to be constructed. District II, Route 3, Section D. Liston Ehorn, Red Bluff, \$6,179; M. A. Jenkins, Sacramento, \$6,573; C. C. Gildersleeve, Berkeley, \$7,211; J. P. Brennan, Redding, \$7,558; L. D. Tonn, Lodi, \$7,724; Stanley P. Cooley, Palo Alto, \$7,904; A. Soda & Son, Oakland, \$8,534. Contract awarded to Frank Embleton, Albany, \$5,735.50.

Realignment Between Sacramento and Dixon

(Continued from page 24)

Further contemplated changes will clip off another 2.20 miles, adding up a total of 13.45 miles which will eventually have been cut from the distance upon the completion of the program.

It is estimated that the annual total saving due to the shortening of distance in the present project will be 5,200,000 vehicle miles. Using 3 cents per mile, which is considered a very conservative figure, the total annual saving will amount to \$156,000, which considerably exceeds the contract price of \$127,300 of the present grading project.

State of California

CULBERT L. OLSON, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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FRANZ R. SACHSE, Assistant Director

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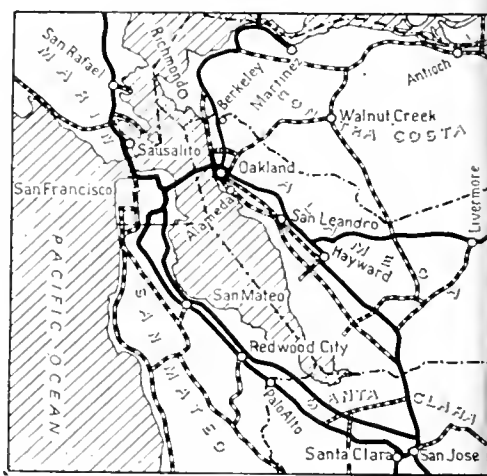
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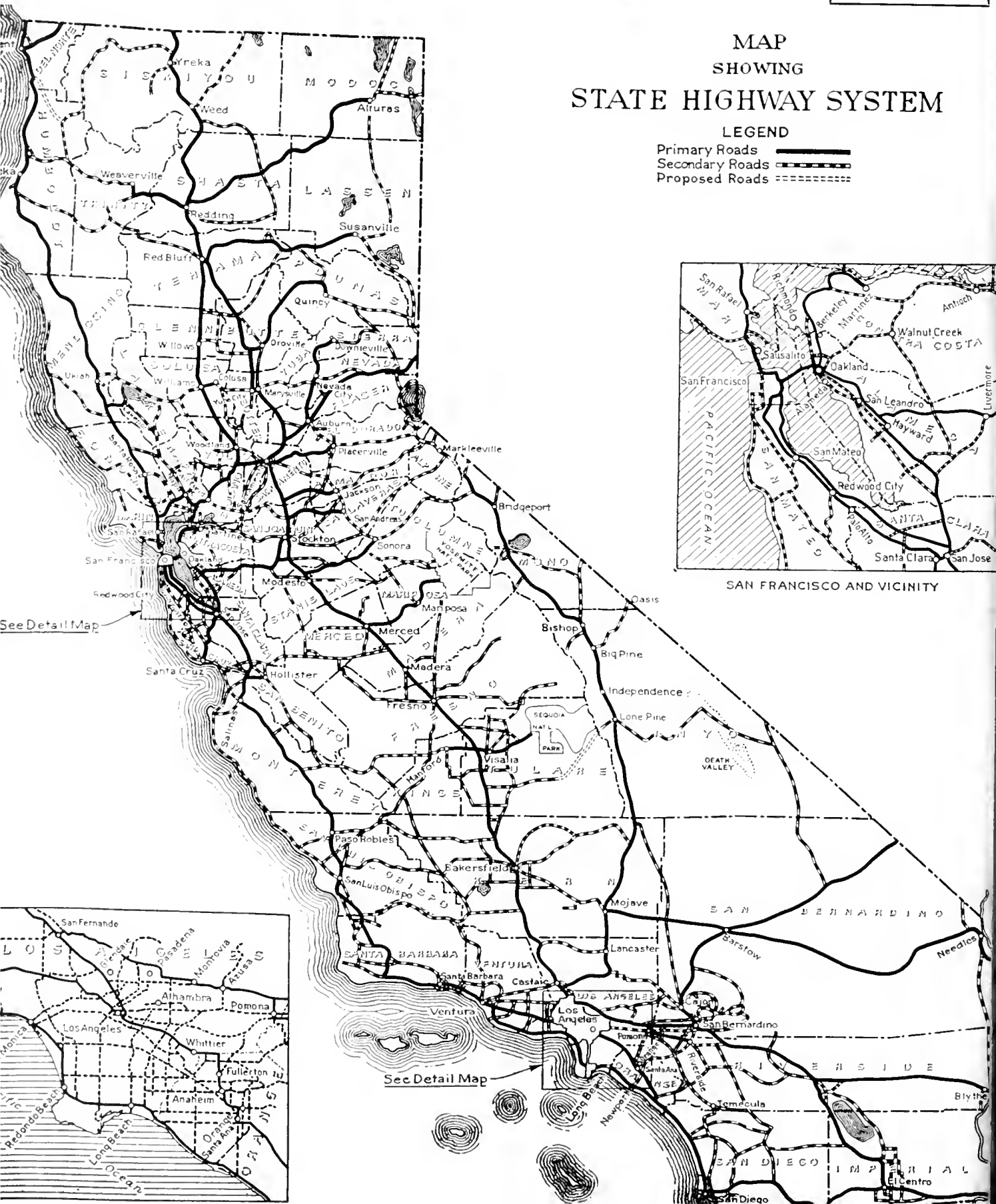
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MAP
SHOWING
STATE HIGHWAY SYSTEM

LEGEND
Primary Roads —————
Secondary Roads - - - - -
Proposed Roads
See Detail Map



SAN FRANCISCO AND VICINITY



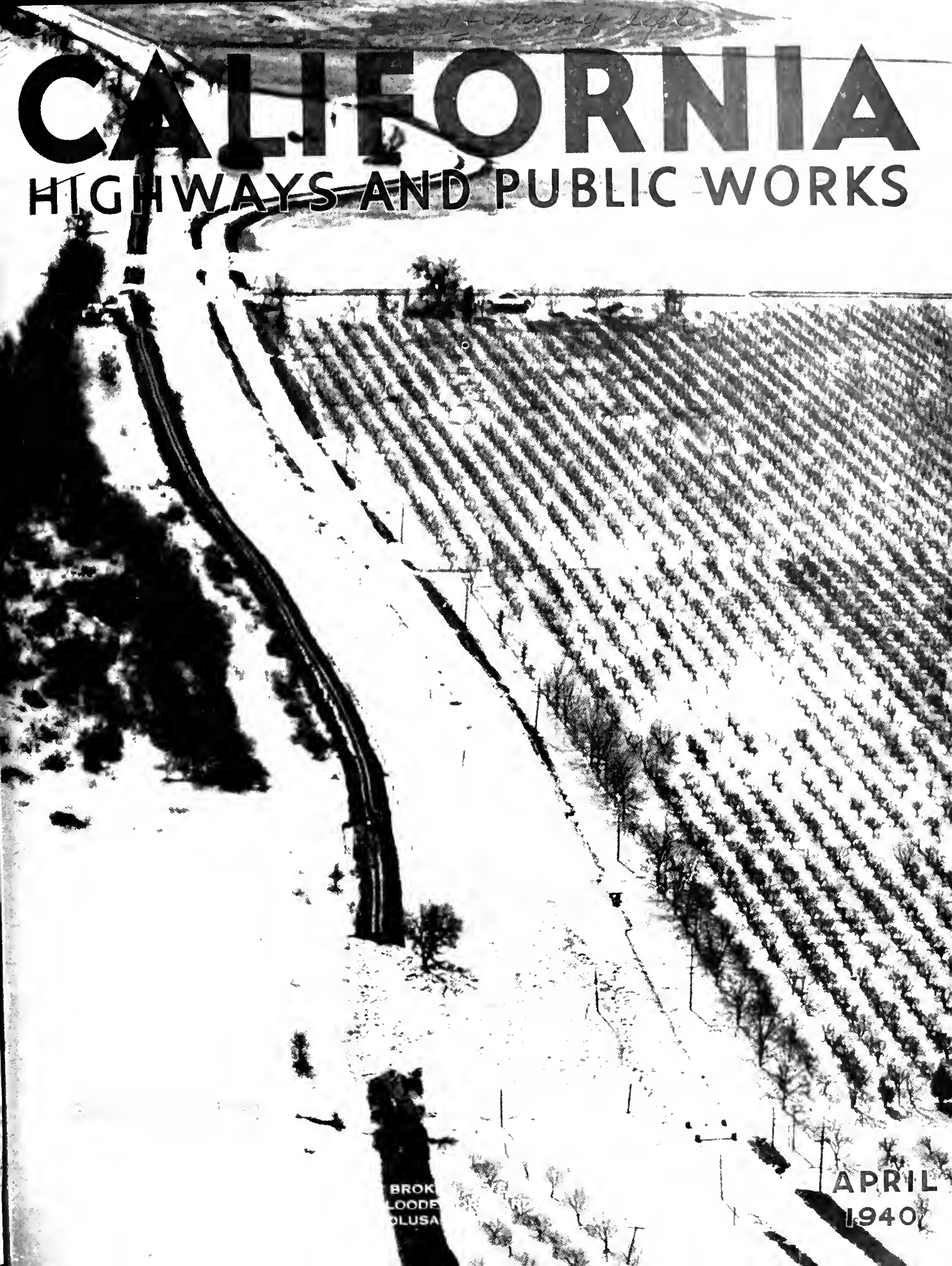
See Detail Map

See Detail Map

Highway Dept

CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



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APRIL
1940

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California

FRANK W. CLARK, Director

C. H. PURCELL, State Highway Engineer

J. W. HOWE, Editor

K. C. ADAMS, Associate Editor

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APRIL, 1940

No. 4

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State Speeds Program to Restore Damaged Levees and Aid Work of Farm Land Rehabilitation

By FRANK W. CLARK, Director of Public Works

GOVERNOR CULBERT L. OLSON moved rapidly this month in gearing the State machinery to top speed for the rehabilitation of areas in Northern California damaged by the severe floods of late February and early March. By proclamation, Governor Olson declared a state of emergency to exist within the boundaries of the Sacramento River Basin and its tributaries and ordered the Department of Public Works to make an immediate survey of the extent of flood damage and to recommend necessary steps for rehabilitation.

Meanwhile, before flood waters had ceased pouring through the levee breaks caused by the flood, the Director of Finance on March 15 made available to the Division of Water Resources \$60,000 from the State Emergency Fund for immediate repairs on the levee system of the Sacramento River and its tributaries. The danger of further flooding from subsequent storms made immediate repair work of the utmost urgency and the Division of Water Resources had crews at work the day following the appropriation of emergency funds.

That this danger was not over-emphasized was borne out by the storm which again caused floods in the upper Sacramento River Basin on March 29 and 30. While this storm was of less intensity than the former it caused a rise in the Sacramento River sufficient to break through patched levees in four places where previous breaks occurred and on which emergency work was in progress. A rapid rise in the Yuba and Feather rivers also seriously threatened reclamation districts in the vicinity of Marysville which had escaped inundation by the previous flood.

GOVERNOR TOURS FLOODED AREA

Governor Olson also made a personal tour of inspection of the damaged area and declared that he felt immediate consideration should be given by the State to rehabilitation work and for a permanent program of flood control. He declared that permanent steps must be taken to curb the rivers of Northern California to assure the development of the Central Valley. He said:

"We have in our great Sacramento and San Joaquin valleys an empire of more than 9,000,000 acres of the finest agricultural lands. It is an area of productivity and of actual and potential wealth such as can be found in very few favored places on the face of the earth. It is a heritage given into our keeping. Less than 1,000,000 people live in this resourceful area and the majority of the present population is located in the larger cities and towns.

"There is no question that ten times this population could find a livelihood, a useful and satisfactory existence, and opportunity and happiness in these wonderful valleys. Today most of this area is held in large tracts away and above the requirements of family farming. It is held in large part by large corporations and by absentee landlords, who themselves have no intention and in fact no means, to put this land to its highest and most productive use.

"It does not take a great deal of imagination to visualize the future of this empire. It will be a land of wealth and contentment, of farms and orchards and homes filled and lived upon by a satisfied and self-sustaining people.

MUST HARNESS STREAMS

"It is to this end and with the vision of the future in mind, that we must commence immediately to harness and control these great streams, which today cause too much damage and send their waters and their power to the sea without bringing their full blessings and benefits to our State and our people."

On March 20 the Federal government through the U. S. Army Engineers office in Sacramento, made available \$100,000 for emergency repair work on the levees of the Sacramento River Flood Control Project and this amount was matched the same day by the State Reclamation Board.

With \$200,000 available the California Debris Commission took over the work of closing the breaks in the levees along the Sacramento River above Princeton which had been initiated by the Division of Water Resources. The Division continued the work of making a temporary closure in the break of the west levee of the Sutter By-pass at Reclamation District No. 70.

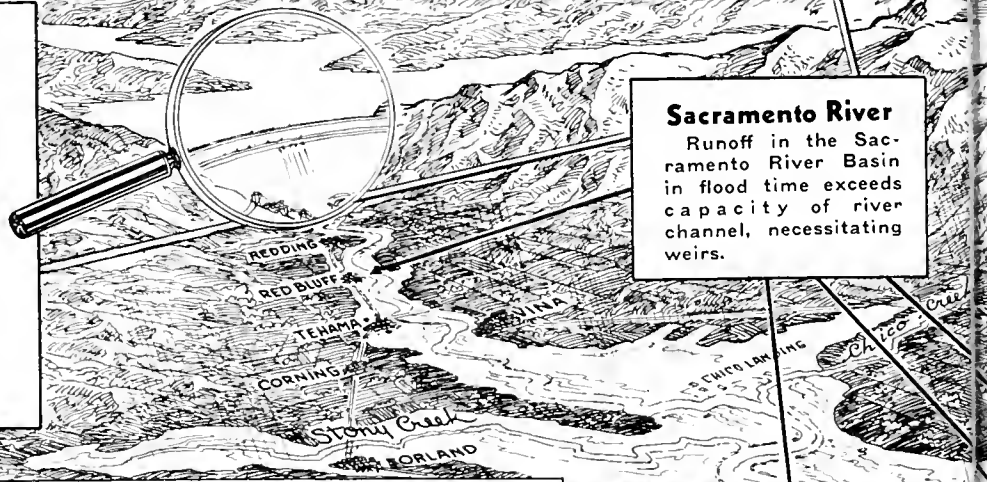
635,000 ACRES FLOODED

In the report to Governor Olson on flood damage which was compiled by the Department of Public Works it was estimated that 635,000 acres of land in the Sacramento Valley were inundated by the floods of late February and early March and that there was \$12,041,600 in property damage in 35 counties in Northern California.

The survey shows that in the 35 counties reporting damage ranged from as much as \$1,744,000 in Sutter County to as little as \$3,300 in Modoc County. Sonoma County stood second in the list with damages estimated at \$968,600 and Glenn County third with \$932,000. Other counties reporting more than one-half million dollars in damages were Solano with \$879,800; Butte with \$831,900, Shasta with \$685,200, Yolo with \$589,600 and Colusa with \$552,900.

SHASTA DAM

Analysis made of flow of Sacramento River at Kennett and Red Bluff during the February-March flood shows that had Shasta Dam been in operation it would have checked flood on upper reaches of the Sacramento River by reducing the peak flow at Red Bluff from 291,000 second feet to 125,000 second feet.



Damage to private property was the most extensive. The report shows \$6,522,800 damage in this classification alone. Cities, counties and public districts reported damage to properties under their jurisdiction totaling \$2,344,000. State property damage was placed at \$1,721,500 of which \$1,267,200 was to highways alone. The Federal government loss was \$631,000 and privately owned public utilities reported damages of \$822,300.

COSTLY LEVEE WORK

The State Division of Water Resources estimates that it will cost \$925,000 to close the breaks in the levee systems and repair wave and current wash of the Sacramento Flood Control Project alone. Of this amount, U. S. engineers estimate that \$563,000 will be required for immediate emergency repair work in filling levee breaks.

The report recommends that in order to make the Sacramento Flood Control Project effective that in addition to rehabilitation work it will be necessary to complete Project levees immediately to full grade and cross section. It also recommends that new surveys of the Project be instituted by the State immediately and that an emergency expenditure of \$2,900,000 be made to cover the repairs required before the next flood season.

For immediate repairs in addition to the \$200,000 already made available, \$363,000 additional Federal and State funds will be required. This amount was estimated as necessary for closure of levee breaks previous to the flood of March 29 and 30 which caused considerable additional damage. No estimate has been made as yet of what will be required to repair the additional damage.

(Continued on page 4)

New Survey of Flood Control Project Needed

FROM the time the white men first settled in the Sacramento Valley there are records of periodic and devastating floods. Even before then Indian legend tells of times when the entire valley was one vast lake. The flood of 1825-26 was outstanding in the memory of the natives and those of 1850 and 1852-53 initiated the pioneers to the powers of the river.

In 1862 the entire central valley was one vast lake and river boats went overland to Stockton rescuing stranded people from the ranches along the way. With these devastating floods in mind, men early began the study of methods to check the Sacramento River.

Early efforts at flood control were largely private and in many cases so constructed that in protecting one section of the valley, they caused heavier damage to other sections.

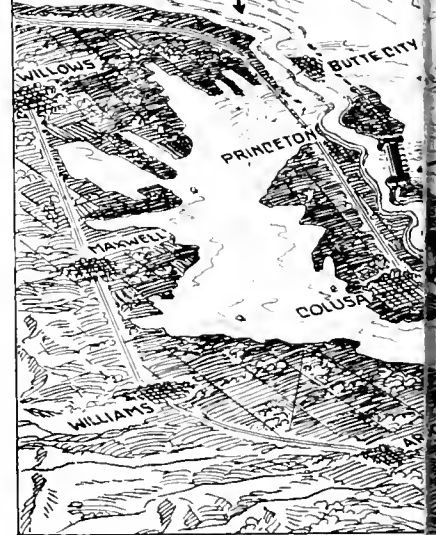
The Sacramento River system is approximately 250 miles long and drains an area of 26,150 square miles. The floor of the Sacramento Valley from Red Bluff to the mouth of the Sacramento River at Collinsville is approximately 150 miles long with an average width of 30 miles. It is generally flat and before levee systems were built restraining the river it was largely subject to flooding during the rainy season.

From 1856 to 1884 hydraulic mining in the tributaries of the Sacramento River added to the flood menace by washing millions of tons

of debris into the river channels and partially filling them.

Prior to 1910 Sacramento Valley land owners had built flood control works at a cost of 8 million dollars and by 1924 had expended a total of \$39,000,000 for this purpose. There were repeated efforts by local State and Federal groups to develop a general Sacramento Valley flood control program. These efforts, however, were unsuccessful until 1910 when the Jackson report proposed a flood control project which is essentially the same as the project now in operation. This project was adopted by the State in 1911 and by the United States with limited financial participation in 1917, and in its present form by the United States in 1928. The engineering plan for the present project provides for an intricate system of levees, by-passes and weirs, which take advantage to the largest extent possible of the natural over-flow troughs.

In designing the project, it was determined that some system must be devised which would take care of a



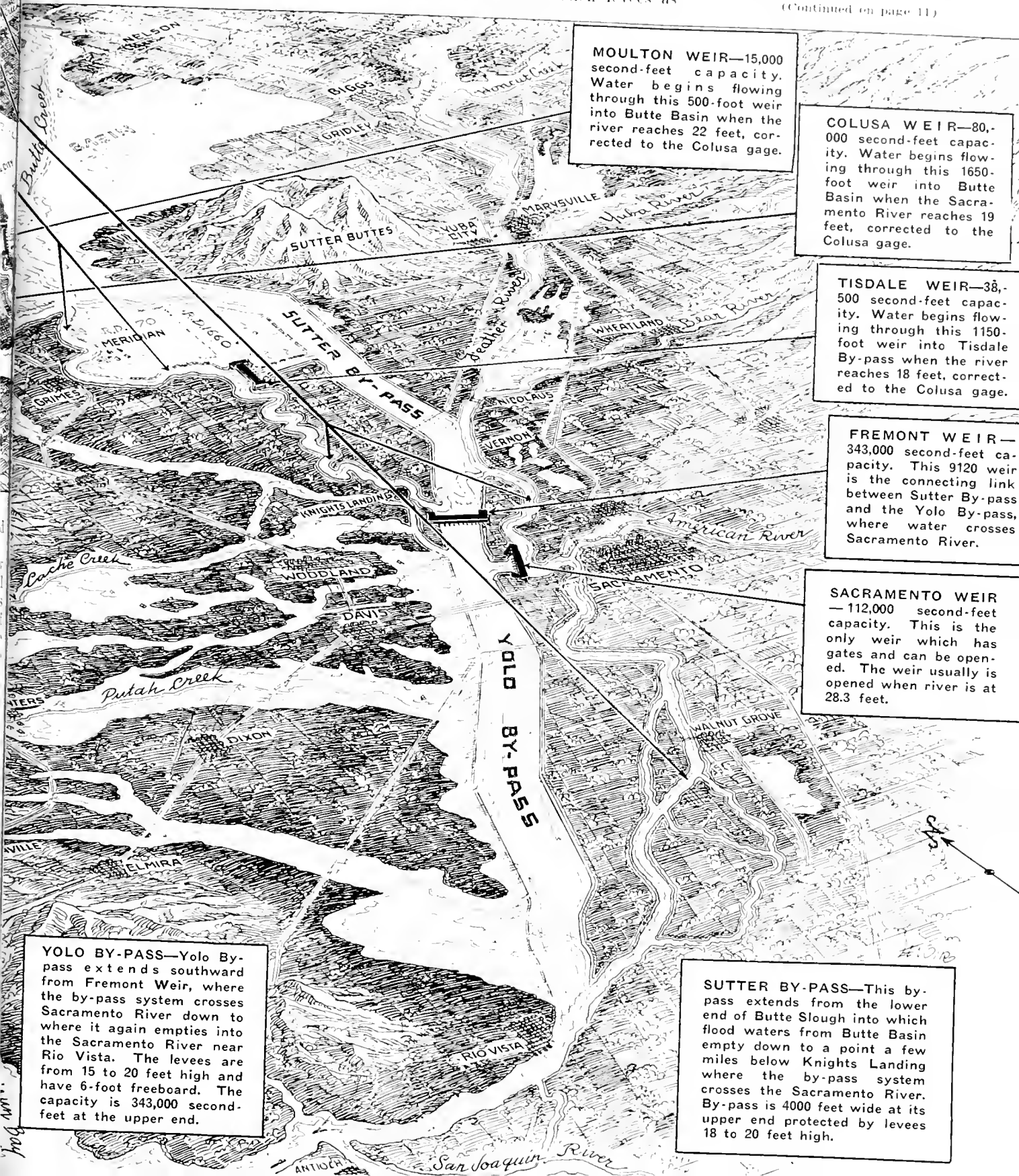
flow of 600,000 second-feet at the mouth of the Sacramento River at Collinsville. As the total capacity of the Sacramento River at Sacramento, even with its present levees is only 110,000 second-feet, it was immediately evident that overflow channels of sufficient capacity to carry the

additional water would be necessary. Starting at the head of the valley where the slope of the river is greater than farther down the valley, the trough of the Sacramento River was found sufficient to carry most of the flood waters in that region. From Red Bluff to Jacinto such levees as

exist are private. The river trough capacity in this stretch is estimated at 260,000 second-feet. The records of heaviest runoff show that the river exceeds this amount only once in about 40 years.

The Sacramento River Flood Con-

(Continued on page 11)



State Speeds Program to Restore Damaged Levees

(Continued from page 2)

The District Engineer, U. S. Engineers Office, Sacramento, advised the Division of Water Resources that the location and cost of emergency repair work on the levees of the Sacramento River Flood Control Project were:

11 breaks on the west side, Sacramento River, between Princeton and Glenn—\$50,000.

5 breaks on the east side, Sacramento River, from Princeton to the south boundary of Parrott Grant—\$60,000.

1 break on the west side of Sutter By-pass at Reclamation District No. 70—\$115,000.

2 breaks on the west side of the Yolo By-pass at Reclamation District No. 2035—\$16,000.

2 breaks on the west side, Yolo By-pass at upper Hastings Tract, \$7,000.

2 breaks on west side of Yolo By-pass, south levee of Lindsey Slough—\$15,000.

4230 feet of breaches on the west side of the Sutter By-pass and north side of Tisdale By-pass at Reclamation District No. 1660—\$300,000.

The estimates cover only expenditures necessary to return the actual breached portion of the levees to the height that obtained before the flood. In addition to this work much additional work will be necessary on other portions of the levee system where, while the levees did not actually break, much damage was caused by wave and current wash. The cost of this additional work is estimated at \$362,000.

FEDERAL AID SOUGHT

Following the flood, preliminary inspection indicated that considerable damage had occurred to several of the Federal Aid Highways in the northern part of the State and in the vicinity of San Francisco.

Because of unusual intensity of the storm, its devastating effect upon the Federal Aid Highway System and the magnitude of the necessary restoration work, the State Highway Department requested emergency financial assistance from the Federal Government for reconstruction of highways and bridges on the system of Federal Aid Highways which have been damaged or destroyed by floods, hurricanes, earthquakes or land slides, and



Governor Olson and officials view levee break north of Princeton. In group, Governor Olson, Director of Public Works Frank W. Clark, E. Vayne Miller, Reclamation Board, State Engineer Edward Hyatt (pointing).

has been allocated \$338,410.

Following the filing of the preliminary application for such emergency relief funds, representatives of the United States Public Roads Administration and the California Division of Highways conducted a joint field inspection of the damaged Federal Aid Highway System and collaborated in determining the nature and extent of necessary restoration measures.

This joint inspection indicated that major damage amounting to approximately \$584,000 had occurred on portions of Federal Aid Highway Routes on the Redwood Highway; the Pacific Highway north of Redding; and the Trinity Lateral; the Feather River Route; and the Williams-Ukiah Highway; and portions of the Roosevelt Highway along the coast in San Mateo County, which is a recent addition to the Federal Aid Highway System.

It is proposed that the work of reconstruction of the damaged roads and bridges and of corrective measures to prevent repetition of such destruction will be performed by contract. If the State's application for emergency relief highway funds is

approved by the Federal Government, the work will be financed jointly with State and Federal funds on the ratio of approximately 42 per cent State and 58 per cent Federal money.

SHASTA DAM NEEDED

Earlier analysis of the effectiveness of Shasta Dam in reducing floods of the nature of the one of February-March, 1940, on the upper Sacramento River were substantiated. Analysis made by the State Division of Water Resources of the regulatory effect which the Shasta Reservoir of the Central Valley Project would have had on the flows of the Sacramento River at Shasta Dam and at Red Bluff had the reservoir been constructed and in operation during the recent flood.

In this analysis it was assumed that the Shasta Reservoir would have been operated not only for flood control but also to meet the basic requirements of navigation, irrigation and salinity control and for the generation of electric power.

The analysis shows that the peak discharge of 182,000 second feet on

(Continued on page 31)

State Highways Suffer Severe Damage from Floods and Slides

By C. H. PURCELL, State Highway Engineer

FOR the second time in a three-year period, State highways in Northern California have suffered severe damage.

As a result of the storm from February 25 to 29 several of the major routes and most of the secondary roads were closed to traffic for periods varying from a few hours to several days. The estimated cost of repair and protection of highways so damaged is \$1,267,200.

Damage to highways during the March storm has not yet been estimated.

A review of records prior to the storm of December, 1937, revealed

information taken from United States Weather Bureau records supplements details previously published in the March issue of this magazine:

RAINFALL RECORDS

Location	County	Rainfall in inches Feb. 25 to 29	Total for February
Ben			
Lomond	Santa Cruz	12.65	22.37
Cloverdale	Sonoma	9.10	15.95
De Sable	Butte	17.20	24.64
Inskip	Tehama	22.07	32.71
Lake			
Spaulding	Nevada	13.71	24.85
Redding	Shasta	8.34	14.57
St. Helena	Napa	9.15	14.10

Fortunately, there was little snow on the ground at the lower elevations

DETOURS LOCATED

As a result of experience gained during the 1937-38 storm period instructions were issued shortly thereafter to the maintenance forces to scout all available detours. The condition of bridges and surfacing on such detour routes was noted and sketch maps prepared. Signs required to properly direct traffic in emergency were then secured and placed in stock. At the beginning of each winter season the detour situation is reviewed and changes noted. This preparation paid dividends in time saved and in public convenience during the recent February storm.



Left—Site of Big Butte Creek Overflow Bridge on State Highway between Butte City and Biggs. Right—Ruins of deck of bridge carried down stream 1000 feet.

that only once—in January, 1909—had there been as great a rainfall in a similar short period for the preceding forty years or more. During the recent storm new high water marks were recorded for the Sacramento River and several other major streams. In reviewing the damaged areas it was particularly noted that the unusual volume of water in normally minor watercourses blocked drainage structures with boulders and debris and frequently caused considerable damage.

Rainfall was general throughout the area affected during the month of February and was especially heavy in several localities for the five-day storm period. The following infor-

mation to increase the run-off, as was the case in 1937. Even so, water was over the highways at many locations for the first time in the memory of the maintenance forces.

During and following unusual storm periods the work of the Division of Highways forces divides into four phases in the following order:

1. Protection and assistance to traffic.
2. Protection of the roads and structures.
3. Emergency repairs to permit traffic to move.
4. Permanent repairs, including correction or protection work, when feasible to prevent recurrence of damage.

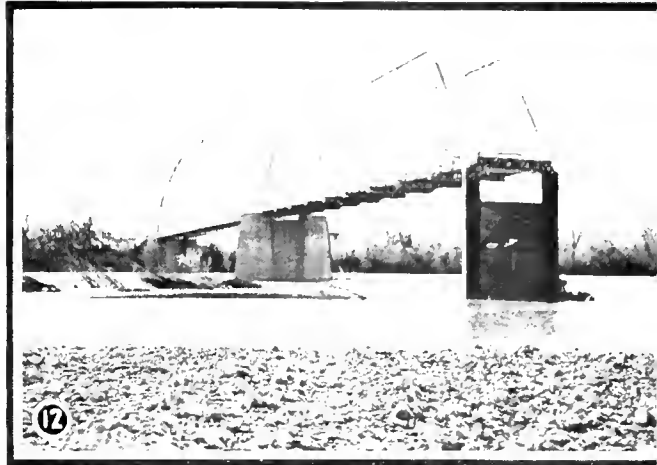
The warning and protection of traffic during the storm was a major responsibility. Slides blocked the roads and sinks or slipouts developed almost instantaneously at many points. A continuous patrol was maintained in such areas so that barricades and lights might be placed with little delay. In flooded areas there was always the possibility that bridge approaches or even the structures might wash out. It was necessary to place markers to designate the traveled way where the water was shallow, and to provide flagmen and patrol cars or trucks to help traffic until overflow water definitely closed the particular road.

(Continued on page 22)



1. View of washed-out trestle approach to Scotia Bridge across Eel River on U. S. 101.
2. Eel River flood waters damaged this section of U. S. 101 at Greenlaw Bluffs north of Dyerville.
3. Wash-out on State Highway 42 in Santa Clara County.
4. Surface and embankment washed out at approach to bridge east of Butte City in Glenn County.
5. Looking west at Chippis Creek to damaged bridge on State sign Route 24, Plumas County.
6. Highway embankment on State Sign Route 32, Tehama County, washed out by heavy rains.
7. Showing highway shoulder cut away to pavement edge on U. S. 299, Trinity County.
8. This rock slide blocked two lanes of the Los Gatos-Santa Cruz highway in Santa Cruz County.





9. Patties Creek overflows the Feather River State Sign Route 24 in Butte County.

10. Section of State Highway 99 destroyed by flood, in Solano County.

11. Washed-out rip-rap at southerly end of sacked concrete protection on State Sign Route 16 in Yolo County due in part to overflow from clogged culvert and high water in Cache Creek.

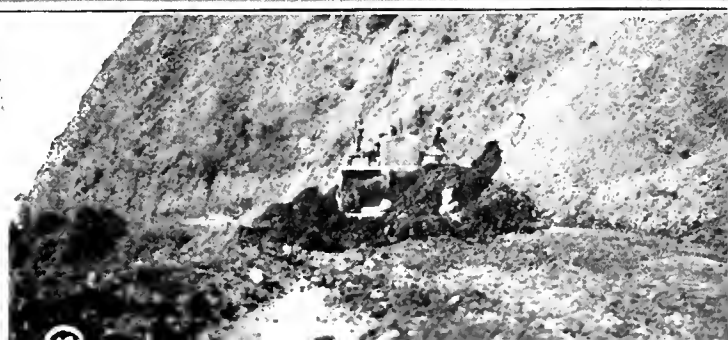
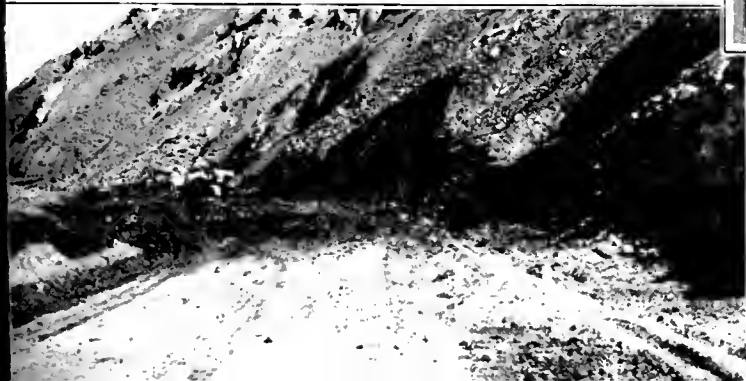
12. East approach to county constructed bridge across Sacramento River east of Redding, State Sign Route 44, swept away by turbulent waters.

13. North approach to State highway bridge north of Redding on U. S. 99 undermined by Sacramento River flood waters.

14. Flood waters of Greenwood Creek washed out this section of Greenwood Creek bridge, State Sign Route 1 Mendocino County.

15. This picture shows slide area on State Sign route 1, San Mateo County. This slide occurred on Pedro Mountain.

16. Maintenance crews clearing slide on State Sign Route 1, Sonoma County, ten miles above Jenner.





This view of Roosevelt Highway improvement project was taken at Escondido Creek looking easterly.

Construction on Coast Highway

By WILLIAM H. MOHR, Assistant Engineer

THE scenic coast highway from Santa Monica northwesterly to Oxnard and Ventura will have another contract completed this fall which will eliminate the many traffic delays and accidents which have occurred on this road in the past few years. To the traveling public this route is better known as the Roosevelt Highway and is designated with federal route markers as U. S. Highway No. 101 Alternate.

For this improvement, a contract 3.74 miles in length was awarded on October 17, 1939, for that portion of the coast highway in Los Angeles County between Solstice Creek, which lies two miles north of Hollywood's Malibu Beach Colony, and Walnut Canyon, near Point Dume. This project joins at Walnut Canyon the contracts to the northwest which were constructed in 1938.

In the past few years this section of the Coast (Roosevelt) Highway has carried a great deal of traffic

over its two-lane road with short radius curves. There have been many serious accidents and the increase of traffic density has resulted in a tying up of vehicles during the summer on week-ends and holidays.

CURVES ELIMINATED

This contract is being built on modern standards with the elimination of short radius curves but follows the existing location in general. The only major deviation from existing alignment is across Latigo Point, between Encondido and Solstice Canyons, where the relocation is northerly of the existing location approximately 800 feet.

An interesting comparison of the proposed improvements is given as follows:

Feature	Existing	Proposed
Total Curves.....	14	5
Minimum Radius.....	250'	2500'
Curves, 500' Radius or under	3	0

Feature	Existing	Proposed
Curves, 1000' Radius or under	7	0
Total Central Angles.....	402°	62°

HEAVY EXCAVATION NEARING COMPLETION

Work was started on this contract October 30, 1939, and is progressing according to schedule. The contract calls for some 400,000 cubic yards of roadway excavation, the major portion of which has already been made. The black adobe surface was removed and wasted but the remainder of the excavated material after being tested was found to be satisfactory for placing in the embankments. Modern, specially built, dirt moving equipment is being used on this job to make the large cuts which are found at Latigo Point and Ramirez Hill. For this purpose, Woolridge scrapers of 15- and 18-cubic yards capacity are being drawn by 105- and 110-horsepower tractors respectively.



New type six-cylinder Diesel tractor pulling 15-cubic yard scraper on Roosevelt Highway construction.

View of construction activities at summit cut between Latigo and Escondido Canyon.





Line change at Latigo Canyon road. New center line shown along right edge of picture eliminates sharp curve around point.

Proper compaction is being obtained in the embankments by the use of five 10-foot sheepfoot tampers.

The relocation of the highway at Ramirez Hill and Canyon eliminates the last of the narrow winding road which was built through the Rindge Estate and first located in 1921. To cut through this hill over 100,000 cubic yards of earth have been removed, most of which has been used to construct the embankments on either side. This pioneer road was necessarily narrow and followed the contours of the rolling hills so as to

cause a minimum of excavation at that time.

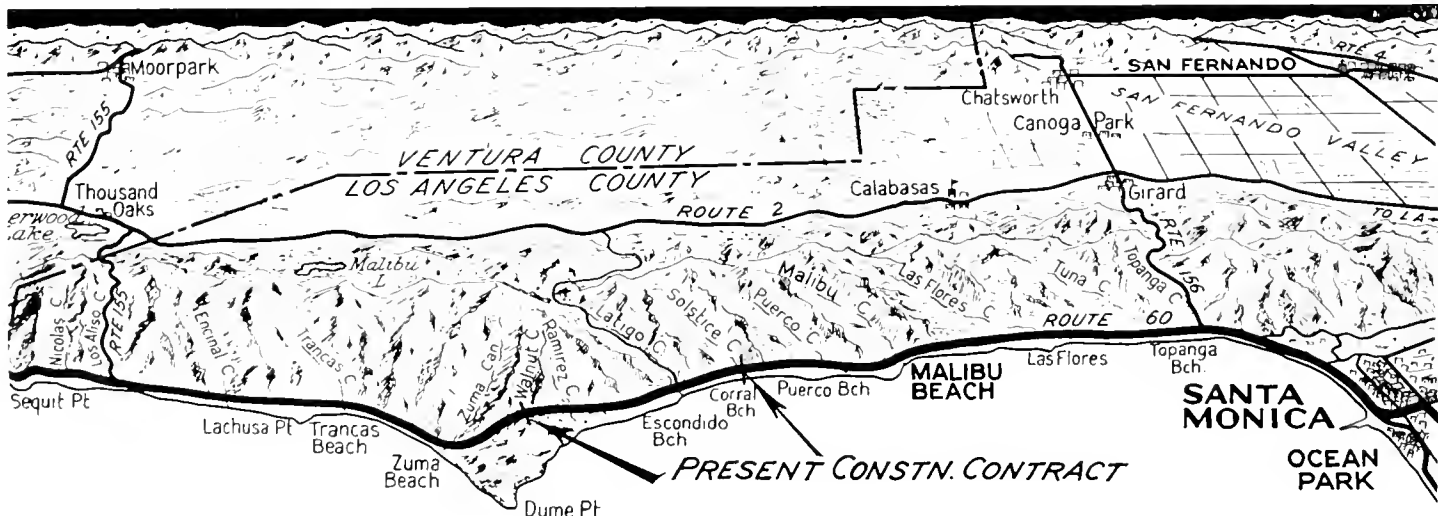
BRIDGES WIDENED

The bridges which lie within the limits of the present contract at Solstice and Escondido canyons have already been widened by the Bridge Department under previous contracts. The width of the completed structures is 76 feet from curb to curb with a 4-foot portland concrete cement center dividing strip to conform with the highway cross section on this contract.

A 10 by 10-foot reinforced concrete box culvert has been completed underneath the new highway at Ramirez Canyon. This underpass will permit cattle which graze in this vicinity to cross the highway without danger to themselves or traffic on the coast highway. The old road is used as an approach to this underpass, which is large enough for persons and vehicles.

The 12 by 13-foot reinforced concrete arch culvert in Ramirez Creek has been extended 255 feet to pro-

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New Survey of Flood Control Project Needed

(Continued from page 31)

trol Project actually begins on the east side at the Butte-Glenn County line and on the west side at a point not far above Jacinto. Overflow through natural channels which empty into the Butte Basin reduce the flow of the river above this point from 260,000 second-feet to 160,000 second-feet. The levees along this section are as yet below standard, either as to grade, section, or both, and are scheduled for further work under the project construction program.

It was in this section of the Sacramento Flood Control Project where most of the breaks occurred in the storm of late February and in the second storm late in March.

RECLAMATION POSSIBILITIES

Butte Basin is a region largely devoted to pasture lands and gun clubs where the State has flowage rights and consequently damage from flooding is of a minor nature.

The project was designed with the assumption that this area might at

some future time be reclaimed and flood waters carried through it in a levee channel leading from a point near Butte City to the upper end of the Sutter By-pass. The storage capacity of the basin as now used is estimated at about a half million acre-feet which has an important effect on floods from the upper Sacramento River. About 130,000 acres in the basin could be reclaimed and may be when Shasta Dam is completed. Estimates indicate that flood flows through Butte Basin will be reduced substantially by the 500,000 acre-feet flood storage capacity of Shasta Reservoir and make it possible to confine the flow to the levees.

At a point about 8 miles above Colusa the Moulton Weir discharges into the Sutter Basin. This is the first of a series of works which has been built into the levee system to reduce river flow at flood times. It is 500 feet long and when the river level rises to 22 feet, corrected to the Colusa gage, it automatically begins

pouring out over the weir which is designed to reduce river flow by 15,000 second-feet. The river capacity between levees from this point down to the Colusa Weir, which is just above Colusa, is 145,000 second-feet.

COLUSA WEIR

The Colusa Weir is 1650 feet long and begins to function when the river reaches a stage of 19 feet (Colusa gage). It has a capacity of 80,000 second-feet and reduces the river flow past Colusa to 65,000 second-feet.

The surplus waters from these weirs and from the natural overflow upstream all empty to the eastward into Butte Basin which has a run-off capacity of 185,000 second-feet at its lower end.

At the junction of the Sacramento River and Butte Slough, part of the water which has been released from between the levees higher up again flows back into the Sacramento River

(Continued on page 30)



Equipment engaged in repairing levee break along Sutter By-pass near Meridian.

Cement Experiments Through the Ages

By LESTER C. MEDER, Assistant Physical Testing Engineer

The following is the first of a series of articles dealing with the development of cement through centuries of experiments dating back to early Assyrian, Egyptian, Grecian and Roman periods and progressing to the present day portland cement. A second article will appear in a later issue of this magazine.—Ed.

HISTORICALLY, portland cement ranks as a comparatively recent discovery. The earliest structures known were built of rammed earth, sun dried brick, or stone blocks set without the aid of cementing material, stability depending wholly upon mass and design. Asphalt or bitumen from natural deposits was probably the earliest adhesive material used, its first extensive use being attributed to the Assyrians.

The earliest structures using a mortar as it is now understood are found in Egypt. The mortar used in building the Great Pyramid was a mixture of sand and a cementitious material, composed of approximately 80 per cent gypsum and 20 per cent lime. This mixture of lime and gypsum was not a manufactured product, but rather an impure gypsum as found in nature. Examination of the mortar shows it to be a mixture of overburned and underburned material. It is not hard to picture the difficulties early masons must have encountered.

As the Egyptians discovered the use of gypsum, the Greeks discovered the use of lime, and in turn, both discoveries were passed on to the Romans.

CEMENT DISCOVERIES

It is not known just how the discovery of puzzolanic cement—the first truly hydraulic cement—came about. However, it seems reasonable that the Romans, in preparing a lime mortar, inadvertently used some volcanic ash for sand, and noticing the greater hardness or strength of the resulting mixture, continued and expanded its use as experience and long service demonstrated its superior qualities as a binding material.

Thus, we see the development of four cements by four widely different cultures: Asphalt or bitumen by the Assyrians, gypsum by the Egyptians, lime by the Greeks, with its evolution into puzzolanic cement in the hands of the Romans.

The remarkable hardness of the walls and the durability of the structures built by the early Romans has led to the impression that the builders possessed secrets long lost. However, such is not the case. After considerable study and comparison of analyses, it has been decided that the secret lies not in the composition but rather in the thoroughness of mixing and ramming. Modern work confirms this. Examination of ancient mortars shows a remarkably close and dense texture, and the presence of unhydrated lime in the interior shows the mass to be impervious to air or moisture. It was the practice to mix a sticky mass of hydrated lime and finely powdered volcanic ash, add the rock and sand and then tamp the mass with heavy weights for hours. It is hard to picture a modern structure being fabricated in such a manner, particularly with the prevailing wage scale.

EARLY EXPERIMENTS

When Europe passed into the Dark Ages with the almost complete cessation of building the development of cements was neglected and practically forgotten.

In 1756 an Englishman, John Smeaton, was called upon to build a cut stone lighthouse on Eddystone Rock. Knowledge of hydraulic cements, or cements that would set and harden under water, was at that time extremely meager. After much experimenting Smeaton found that the best results were obtained from a lime that contained considerable clay as an impurity.

Thus, inadvertently, was hydraulic lime discovered.

Out of Smeaton's work came the knowledge that a better cement could be made from the soft clayey limestones than the hard, dense limestone. At first, the material was only lightly burned to expel the carbon dioxide, use being made of only the material that slacked in water, no attempt being made to fuse the material, and then grind it to a fine powder.

ROMAN CEMENT

Investigations of a desultory nature followed for some years. In 1794 it was found that hydraulic cement could be made by calcining nodules of argillaceous or clayey limestone and finely grinding the resulting clinker. To this type of cement was given the name "Roman Cement." This cement, being quick setting, was extensively used in construction in the tidal zone and under water. It is very similar to the Rosendale cement used in the construction of the Erie canal in New York, in the early part of the nineteenth century.

There is much confusion in the history of the development of portland cement during the early part of the nineteenth century, a period in which bricklayers and builders were burning and preparing their own mortars. The properties of these different mortars depended largely upon the impurities in the limestone from which the lime was prepared, and the temperature at which it was burned. The resulting cements varied from hydraulic limes to "Roman Cement."

In about 1812, Vicat found that an artificial hydraulic lime could be prepared by calcining an inti-

(Continued on page 27)

New State Office Building Opened and Fully Occupied in Sacramento

By W. K. DANIELS, Acting State Architect

GENERAL occupancy of the new State Business and Professions Building, begun on January 15th, 1940, signified the completion of another much needed State structure and when the flags were raised on March 8th following, the building was fully occupied, evidencing the need for taking this step to provide proper office space for governmental functions rightfully located in the Capital City of Sacramento.

Under Governor Olson's administration and under the leadership of Frank W. Clark, Director of the Department of Public Works, it has become the policy and will continue to be the policy of the Division of Architecture to design and plan State structures with maximum simplicity, economy, practicality and efficiency being borne in mind at all times.

In this respect I believe we have accomplished our objective.

The building itself cost approximately \$1,375,000 to construct. This is equivalent to \$5.66 per square foot for gross floor area, which is a very conservative cost for this class of construction. It is structurally designed in reinforced concrete to resist fire and earthquakes and maximum daylight is afforded through large window openings. Complete air-conditioning will provide proper cooling in summer and warming in winter, supplying a change of air eight times an hour under normal conditions.

A great deal of study has been given to efficient office layouts providing color schemes beneficial to the eyes; freedom of movement in the corridors, stairways and elevators and scientific acoustical treatment throughout to absorb sound.

The architectural design and planning create dignity, beauty and charm by the application of simplicity to the exterior and directness of plan arrangement to the interior.



View of entrance to new State Business and Professions Building.

We all appreciate the fact that no one person can accomplish alone the construction of a project of

this nature and I wish at this time to express my appreciation for the cooperation received by our organ-

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View of new Turlock grade crossing overpass which was officially dedicated on April 5.

Turlock Overhead Dedicated

WITH appropriate ceremonies, the new \$300,000 overpass on U. S. 99 at Turlock was officially dedicated on Friday, April 5, by Director of Public Works Frank W. Clark, representing Governor Culbert L. Olson, and State Highway Commissioner Iener W. Nielsen of Fresno.

This completed project removes one of the last major traffic hazards on the main highway between Sacramento and Los Angeles.

A program of music by the Turlock High School band and addresses by State and local officials highlighted the dedicatory program. A luncheon at Hotel Carolyn tendered by the Turlock Chamber of Commerce and civic organizations preceded the ceremonies at the overpass.

Mayor Roy N. Day of Turlock acted as master of ceremonies at the over-

pass and President E. Glenn Drake of the Chamber of Commerce presided at the luncheon. Speakers at the luncheon and dedication included Senator J. C. Garrison of Modesto; Byron Scott, Secretary of the Highway Commission; District Highway Engineer R. E. Pierce of Stockton; Fred W. Paulhorst, Bridge Engineer of the Division of Highways; Leo Smith, Public Works; Assemblyman Hugh P. Donnelly, C. C. Crowell, Chairman, Stanislaus Board of Supervisors, and Franz Sachse, assistant Public Works Director.

Senator Garrison read the following telegram from Governor Olson:

"I sincerely regret that official business in the southern part of the State keeps me from being with you in Turlock today. We can be justly proud of our great highway system, and I should have enjoyed participating in

the ceremonies of opening the Turlock overpass to the use of the public. I congratulate your community and those who helped in this important additional safety factor on our publicly owned and maintained highway system."

Miss Shirley Raymus and Miss Betty Green, Drum Majorettes of the Turlock High School band, wielded shears to cut a blue and gold ribbon stretched across the overpass, thus throwing the structure open to traffic.

In his dedicatory address, Director Clark took occasion to praise Senator Garrison and Assemblyman Donnelly as "two public servants whose every vote is controlled by the true welfare of their district and of the State and not by the dictates or demands of any particular pressure group or individual."

Speaking of Turlock, Clark said,

"This community is a living, breathing example of the ideal for which Governor Olson stands. For a great many years now you have recognized that public ownership of your water and power resources is an essential element of your prosperity. Here in Turlock, and in your neighboring community of Modesto as well, your water rate, your power rate, your tax bills and your prosperity are daily reminders that the common good is best served by the public control of our great resources.

"We, in Sacramento, know that one example such as that set by your community and you, its citizens, is worth a thousand speeches. We know, and I am sure that you know, that the low water rates that help your farmers to survive when others go under are in large part due to the fact that the power you generate at Don Pedro Dam helps to pay the bill for the water.

"I think you will agree with me when I say that the State of California has done a pretty good job with the many vast enterprises it has undertaken. It was public money and public enterprise that built the San Francisco-Oakland Bay Bridge, and it was public money and public enterprise that built the overpass we are building today. This overpass is a unit in a public utility larger than any other in the State—the California State highway system."

The railroad crossed by the overpass is the main Southern Pacific line down the valley, carrying fast passenger trains, with heavy freight traffic, especially during the harvest season. Since 1929 there have been seven accidents at this crossing in which one person was killed and three were injured. It is thus obvious that the construction of this overhead separation will provide a safeguard to the traveling public as well as making an appreciable saving of time.

The structural features of the project were described in an article in the November, 1939, issue of "California Highways and Public Works," at which time the project was about 75 per cent complete.

Studies showed that an overhead structure was more desirable than an underpass owing to the high water table in this area. The completed separation presents a pleasing example of modern structural design. A 50-foot roadway provides for four lanes of vehicular traffic over the tracks, while

two sidewalks provide for pedestrian travel. The structure is approximately 1250 feet long, and rises above the flat valley to clear the main line Southern Pacific tracks by 23 feet.

Starting from a dangerous right-angle crossing of the tracks in 1913, the alignment has been gradually improved to facilitate the movement of the heavy highway traffic of more than 6000 vehicles per day, but it was not until a Federal grade separation allotment was obtained in 1938 that the danger of crossing the tracks at grade could be removed. The contract was awarded to the Union Paving Company on February 8, 1939.

The final cost of the separation will be about \$295,000, with \$287,000 spent for the structure and about \$8,000 expended on railroad work.

The separation provided about 83,000 man-hours of work, not counting the labor expended in furnishing the materials for the project. There were 6200 cubic yards of concrete, 1,648,000 pounds of structural steel, and 696,000 pounds of reinforcing steel used in the structure.

A subsequent contract for 0.3 miles of four-lane divided highway approach work was also awarded to the Union Paving company on January 30, 1940, and the work has progressed to the point where one of the two divided highway strips was available for use at the time of the dedication ceremonies.

A total of \$13,000,000 has been spent on grade separation work in California since 1935. Of this amount \$1,294,000 has been spent on this route, the Golden State Highway, (U. S. 99), at the following locations:

Union Avenue at Bakersfield	\$97,000
Oil Junction at Bakersfield	60,000
Famoso Underpass	293,000
Delano Underpass	124,000
Calwa Overhead at Fresno	193,000
Livingston Underpass	232,000
Turlock Overhead	295,000

Opening this link in the main highway (U. S. 99) between Sacramento and Los Angeles leaves one crossing at the southerly city limits of Fresno as the only remaining main line grade crossing on the route north of Los Angeles not yet separated.



Ribbon cutting scene at dedication of Turlock overpass. Left to right: Mayor Roy M. Day, Turlock; Assemblyman Hugh Donnelly, Betty Green, Director of Public Works Frank M. Clark, Shirley Raymus, Supervisor Charles C. Crowell, Highway Commissioner Iener W. Nielsen, Fresno.

Proposed Cut-off Between Rio Vista and Lodi Will Shorten Distance 11.1 Miles

By R. E. PIERCE, District Engineer

THE Legislature of 1921 added a road to the State Highway System designated as Rio Vista to Lodi, which was described as follows:

"The improved county road extending from the town of Rio Vista in the county of Solano to the City of Lodi in the county of San Joaquin, crossing the Sacramento River at Rio Vista, thence crossing Brannan, Andrus and Tyler islands to the San Joaquin County line between Tyler and Staten Island, thence crossing Staten Island to the main land in San Joaquin County on to the improved county highway in San Joaquin County; thence through Thornton in a general easterly and southerly direction to the City of Lodi."

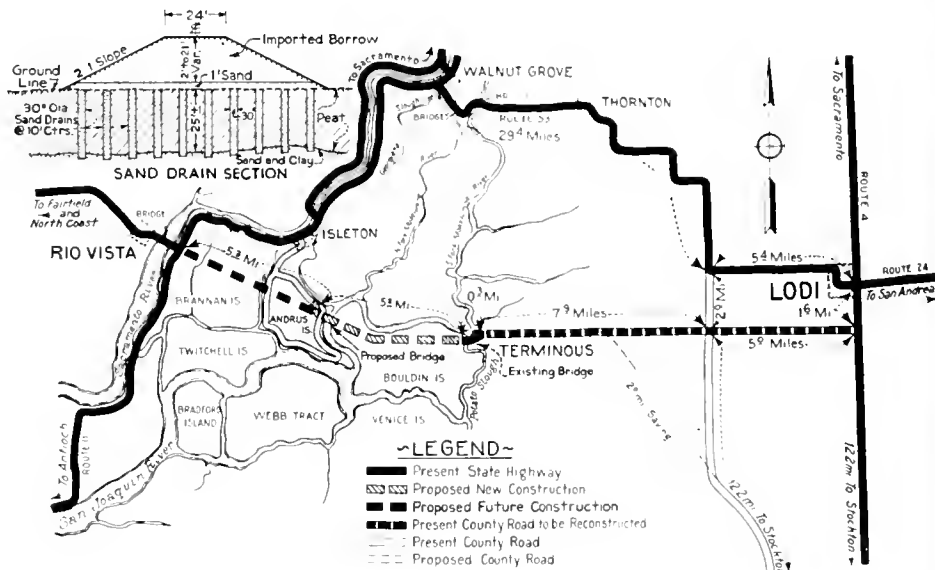
A glance at the map will indicate the very indirect and tortuous designated route that was followed. The stretch from Isleton to Walnut Grove along the top of the Sacramento River levee has never been improved beyond oiling the top of the levee, partly due to the fact that the levee is below the grade established by the State Reclamation Board and partly because a county-built paved highway extends between the same points on the other side of the river. This is also a State highway, having been taken into the State system in 1933.

In addition to the poor alignment, three drawbridges are involved; one across Georgiana Slough, one across the North Fork of the Mokelumne River, and one across the South Fork of the Mokelumne River. All these bridges are substandard in strength, width and speed, and all have sharp right-angle turns on their approaches.

In view of all the poor features of this road it was always considered more as a local road and a more direct route has been under consideration for many years.

In 1933 the Legislature changed the 1921 act, omitting any reference to intermediate points; simply tying in from Rio Vista to the State highway near Lodi.

Following this a general route was decided upon, using the existing



Sketch map shows proposed Rio Vista-Lodi cut-off.

county road known as the Kettleman-Terminous Road from Terminous to Route 4, south of Lodi. From Terminous to Rio Vista it was planned to run by a very direct route across Bouldin, Andrus, and Brannan Islands. During the 1935-37 biennium the first unit on the new location, a drawbridge across Potato Slough at Terminous and the east approach was constructed. This eliminated a county operated ferry here, but due to there being nothing but a few miles of indifferent county road along the levee on Bouldin Island, its use was limited to local traffic.

Nothing further was done during the 1937-39 biennium.

In the present biennium funds have been set up to build the road across Bouldin Island and construct a drawbridge across the Mokelumne River. A short section of road to the west of the bridge is planned to connect with the county road leading to Isleton from whence the present paved State highway from Isleton to Rio Vista will be used temporarily, until funds are available to finish the direct route to Rio Vista.

During the construction of the east approach fill to the Potato Slough bridge considerable difficulty was experienced after the fill was ten to twelve feet high by rapid settlement and heaving of the peat land on either side, as well as a movement of the Slough levee towards the channel. This seemed such a threat to the safety of the levee that any further filling was stopped and a pile trestle, 327 feet long, was placed from the levee easterly.

The Highway Testing Laboratory personnel have for some time been installing the so-called sand drains as a means of achieving a more rapid stabilization of unstable soils under fills. It was considered that an excellent opportunity is available here for comparing the effects of using these drains on the new west approach to the existing Potato Slough Bridge with the fill on the east approach built without sand drains.

If the test proves effective it is thought that most, if not all, of the trestle approach originally planned here and on the two approaches to

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"Burning of the Minnie A. Caine"

IN THESE days of sea battles and scuttling of ships, it is no wonder if residents of the Santa Monica Bay district, who might have been awakened in the early morning hours of December 22, 1939, were startled to see a two hundred fifteen foot vessel aflame from bow to stern, and only a few yards off shore. To the State Highway maintenance forces, however, even though the work was quite unusual, the burning of the "Minnie A. Caine" was only another one of those jobs that they might be called upon to do any hour of the day or night to protect our highways from destruction. The story goes like this—

The history of the "Minnie A. Caine," an 880-ton, four-masted schooner dates back to 1900, for, it was in that year this wooden wind-jammer was built in Seattle, Wash. It was in service between Seattle, Australia, South Africa and Japan for several years, but in 1931, Captain Olaf C. Olson purchased the boat, and anchored it six miles off the Santa Monica Pier where it was used as a fishing barge until September of 1939.

ROMANTIC HISTORY

Some of the earlier romance of the boat is told in a novel written in 1929 by Joan Lowell and titled "The Cradle of the Deep." In it, she states that her father was captain of the boat, and described some thrilling adventures that occurred during the first seventeen years of her life that she was on board the ship, and that finally the "Minnie A. Caine" had burned at sea. However, in an interesting article appearing in the December, 1939, issue of the Readers Digest, it was brought out that shortly after the book was published, its claim to authenticity had been questioned, and it soon developed that the boat had not actually burned as related in Miss Lowell's book, but was still on the seas.

In fact, the "Minnie A. Caine" was still in use as a fishing barge until the afternoon of September 24, 1939, when, following directly upon the break of four days of unprecedented hot weather in Southern California, a storm of hurricane proportions struck the Malibu coast north of



Menacing sandbar was forming between ship and shore when this picture was taken

Santa Monica, and the boat broke its anchor chain in the seventy-mile-an-hour gale, and drifted northerly some seven miles until it grounded approximately one hundred yards from Roosevelt Highway, near the intersection of Sunset Boulevard.

WRECK ENDANGERS HIGHWAY

All of the patrons of the boat had been removed by small boats before the worst of the storm struck, leaving Captain Olson and five members of

the crew aboard. A most spectacular and heroic rescue was made by members of the Life Guard Service in getting these six men to shore. Captain Olson was the last man to leave the boat.

When the storm abated, tugs attempted to pull the barge from the sands, but were unsuccessful. The vessel, therefore, remained in this position, and it was only a few days before the ocean built a sand bar

(Continued on page 26)



All that remained of "Minnie A. Caine" after burning

Painting Problems Involved In Maintenance of Bay Bridge

By C. S. HAMILTON, Associate Bridge Engineer

BACK in 1935 when it came time to paint the San Francisco-Oakland Bay Bridge, then approaching completion, there was considerable speculation as to what effect salt spray, fog and weather conditions generally would have upon the paint formulae specified for use.

Application of the fourth coat on the original contract started in June, 1936, and was about finished by the end of the year; hence, a large percentage of the bridge surface has had a service exposure of approximately three and one-half years.

During 1936, about 60,000 gallons of paint were applied under the original painting contract. It was to be expected that with such a volume of paint and the urgency of completion under often adverse weather conditions, and conflict with concurrent contracts, occasions would arise on which a 100 per cent performance from the application viewpoint would be impossible. With this perspective, it is not exaggeration to say that the materials and procedures contemplated by the contract specifications have been entirely satisfactory.

The bridge was opened to traffic on November 12, 1936, and as of March 31, 1940, a total of 32,680,961 vehicles have crossed the structure.

MAINTENANCE BEGAN IN 1937

Maintenance painting operations were started on October 1, 1937, with a small crew of one foreman and ten painters. This force has been increased at intervals and the present crew now numbers two foremen and thirty painters. The present conception of the maintenance problem contemplates an ultimate crew of about forty-five painters. It is expected that this complete force will be gradually built up in the next two years.

The present condition of the

painted surface fully justified the initial preparation of the surface for painting by thorough sandblasting, and the selection of the formulae for the various coats.

Some failures have occurred but the percentage of the total surface affected to date has been gratifyingly small and distinctly not of a nature to cause alarm. Certain of these failures, by virtue of complete job records, can be traced to conditions pertaining to the time of application and are obviously of small concern when confined to minor areas. Failures of this characteristic type would not raise the question of adequacy of either materials or technique.

Other types of failure, again of small extent, can be attributed to improper selection of materials for the particular exposure. One such type is the breakdown of paint film from the action of salt spray on the lower deck roadway steel on the low truss spans at the Oakland approach. Another is the breakdown of film on certain well-defined areas on the upper deck floor system which is

attributed to acid corrosion arising from SO_2 present in the exhaust gases of diesel trucks operating over the lower deck of the bridge.

Both of these latter type failures could hardly have been anticipated prior to service experience nor, if anticipated, could the limits of surface liable to such attack been so well defined as to warrant a change in materials to protect those particular areas. Observation and correction of both conditions is the proper function of maintenance.

NEW FORMULA ADOPTED

In the case of the salt spray attack, this is largely accomplished at the present time by the substitution of coal tar products for metal oxides in the vulnerable areas. In the case of the areas affected by SO_2 , the breakdown noted had seldom proceeded beyond the two top films. This indicated a change in formulation of the final coat to provide increased acid resistance. Experience of approximately one and one-half years with the new formula can



Cleaning Bay Bridge surfaces before applying new coat of paint



These pictures show painting crews at work on San Francisco-Oakland Bay Bridge.

hardly be conclusive but has indicated a satisfactory performance.

In a few instances a graphite paint has been applied as a final coat on parallel surfaces for comparative test. A small amount of this was purchased by brand name and the remainder under standard specification of the Division of Highways of the State of California.

Experience to date with the red lead and oil paints for the first three coats has been generally satisfactory. The slow drying characteristic operates to reduce the available suitable painting weather for these paints but maintenance painting can generally be scheduled to overcome this objection in part. The lead and oil formulae of the original contract are being used on maintenance and no change is contemplated at this time.

CLEANING NECESSARY

One of the problems of maintenance painting is the preliminary cleaning of the surface prior to paint application. Obviously this is necessary in any location but even more pertinent in a location similar to the San Francisco-Oakland Bay Bridge where, in addition to normal dust, surface deposits have a high soot content from industrial plants and salt deposits from marine spray. This preliminary cleaning may average better than fifty per cent of the cost of maintenance painting.

For the past six months, the bridge has been cleaning accessible surfaces

(Continued on page 31)

Bay Bridge Traffic Again Increases

MARCH vehicular traffic on the San Francisco-Oakland Bay Bridge continued to set the high pace which was first notably evidenced in February. Director of Public Works Frank W. Clark reported to Governor Olson.

"Increased traffic," Clark said, "apparently coincides with materially improved general business conditions in the bay area as reported by the San Francisco Chamber of Commerce and of course the reduced tolls have had their beneficial effect. Gross traffic for the month was 964,360 vehicles, as compared with 822,914 a year ago. This is an increase of 17 per cent. If the traffic to Treasure Island is eliminated the growth is even greater and increased from 658,272 in 1939 to 945,895 in 1940. This increase is 43 per cent."

The total tolls collected were less than the revenues for the same month a year ago. In March, 1939, \$422,904 were collected, and this year, \$354,816.

The San Francisco-Oakland Bay Bridge was only exceeded by the Delaware River Bridge in Philadelphia in traffic carried in February and undoubtedly maintained this position in March. The comparison with other leading toll structures of the United States for February is shown below:

Structure	Vehicles Carried February, 1940
Delaware River Bridge, Philadelphia.....	877,502
San Francisco-Oakland Bay Bridge.....	842,070
Holland Tube, New York.....	786,638
Triborough Bridge, New York.....	579,160
George Washington Bridge, New York.....	420,137
Golden Gate Bridge.....	260,882
Lincoln Tube, New York.....	246,330

March traffic on the San Francisco-Oakland Bay Bridge and comparative figures are:

	March 1940	March 1939	February 1940	Total Since Opening
Passenger autos and auto trailers....	879,559	738,813	767,371	30,091,658
Motorcycles and tricycles.....	3,301	3,037	2,699	138,173
Buses.....	17,990	15,705	15,380	490,791
Trucks and truck trailers.....	46,612	47,138	40,984	1,448,443
Others.....	16,898	18,221	15,636	511,896
Total vehicles....	964,360	822,914	842,070	32,680,961

Deaths in Traffic on Increase

Traffic deaths are going up again! A nation-wide survey revealed that the traffic death toll in February increased 10 per cent over the corresponding month in 1939, marking the fifth consecutive month in which the total has exceeded the same month of

the preceding year.

Motor vehicle fatalities in February totaled 2170 lives, an increase of 200 over the 1970 deaths in February, 1939, the sharpest increase registered since March, 1937. For the first two months of this year 4800 persons were killed, a 5 per cent increase over 1939.

More Improvement on U. S. 50 East of Folsom Is Undertaken

WORK is now under way on another unit of the contemplated reconstruction on the Sacramento to Placerville section of Transcontinental Route U. S. 50 and it is anticipated that traffic will be routed over the new work early this fall.

This is the second unit and is located in Sacramento and El Dorado counties, between $3\frac{3}{4}$ miles east of Folsom and $2\frac{1}{4}$ miles east of Clarks-ville. The first unit, extending from $1\frac{1}{4}$ miles west of El Dorado to Clark's Corner, was completed in 1938 and covered by articles in "California

Highways and Public Works" in December, 1937, and July, 1938.

The existing road which will be superseded by the present construction consists of a 12-foot x 4-inch portland cement concrete pavement, the Sacramento portion of which was built in 1915 and the El Dorado County portion in 1920.

In 1929, 3-foot x 4-inch oil-treated rock borders were added. There are many short radius horizontal curves, some with radii as short as 100 feet, and many sharp vertical curves with very limited sight distance.

The narrow width and poor align-

ment and grades make the present road entirely inadequate to meet the traffic requirements of the larger numbers of cars and the higher speeds which now prevail.

INCREASED TRAFFIC

During the summer months the ordinary commercial and passenger traffic between Sacramento and Placerville is greatly augmented by and increasing amount of travel to the American River and Lake Tahoe recreational areas. Due to the increasing popularity of snow sports during the past few years the winter



Shovel engaged in heavy excavation work in rock cut on realignment east of Folsom.



This is another view of construction on U. S. 50 between Folsom and Clarksville in El Dorado County.

traffic has also increased.

In order to meet more adequately the demands of this increased traffic traveling at higher speeds, the new road has been generally designed for a minimum passing sight distance of 1,600 feet and a minimum non-passing sight distance of 350 feet.

At one vertical curve, where it was impossible to obtain the desired sight distance, four traffic lanes were provided in order to maintain the same design standard as was used for the rest of the project. The minimum radius of curvature is 1,500 feet except at the connections to the old road and the maximum grade rate is 7 per cent. The new alignment is much more direct than the old, resulting in a distance saving of about 1.9 miles. The total length of the new project is 5.84 miles.

The project is being surfaced with

plant-mixed surfacing, 22 feet by 0.21 feet, on crusher run base 23 feet wide by 0.4 of a foot thick. Preliminary investigations and soil tests of material to be encountered in roadway excavation indicated that over a large part of the project it would be necessary to cover the inferior materials for the full roadbed width with a layer of selected material before placing the crusher run base and surfacing. This material is being selected from roadway excavation within the limits of the project.

Drainage facilities required are mostly of standard types. There were several springy areas within the limits of the project where perforated metal pipe underdrains were provided to care for the drainage. During construction several more areas of this type were encountered and it has been necessary to increase the

amount of underdrain construction considerably.

At the crossing of Carson Creek, after a comparative study of several types of structures, it was decided that the most economical installation would be a triple 10-foot x 10-foot reinforced concrete box culvert, 103 feet in length. Due to the excellent foundation conditions, it was possible to eliminate the customary bottom slab in designing this structure.

The contractor is making rapid progress on the project and it is now anticipated that the grading will be completed about May 1 and that the entire contract will probably be finished in August.

The total cost of the project will be about \$240,000. The contractor is the firm of Hemstreet and Bell and the resident engineer for the State is Mr. J. W. Corvin.

State Highways Suffer Severe Damage

(Continued from page 5)

During a storm it is possible to limit the damage by keeping drainage channels clear, removing drift which might clog or damage structures, and similar preventive measures. Every man not required for the protection of traffic was assigned to this work. At least \$20,000 was expended during the storm period simply for protection of traffic and the highways.

During and immediately after the storm work was concentrated at points on major traffic routes where serious damage blocked the road. A few such cases may be mentioned:

At Brisbane, on the Bayshore Highway south of San Francisco, some 60,000 cubic yards of material from the landslide at that point came into the road section, blocking three lanes of this four-lane road. This road carries an average daily traffic of approximately 25,000 vehicles and interference with the free flow, even for a few hours, is a serious matter. The slide occurred at 2 o'clock in the morning and before daylight a large power shovel and trucks were at work on its removal. It was necessary to handle this heavy traffic under one-way control for a two-day period.

At Scotia bridge on the Redwood Highway, high water in the Eel River undermined the footings of two bents and 75 feet of the north approach collapsed. This blocked through traffic on this important route, as the only available detour was difficult even for passenger cars and impossible for heavy trucks. The collapse occurred during the night of February 28. The replacement trestle, which is some 60 feet in height, was placed in service March 4.

Most of the interference with traffic in the Colusa and Meridian territory was due to flood water from the Sacramento River which escaped through breaks in the levee system. Damage to the State highways from this source was negligible in comparison to losses sustained by reclamation districts and private property in that area. There was, however, considerable damage by streams immediately tributary to the Sacramento River in Glenn and Butte counties.

Hambright Creek overflowed north

of Orland and damaged the bridge approaches and portions of U. S. 99 at that point. At Stony Creek Bridge on State Highway Route 47, west of Hamilton City, about 200 feet of the approaches and the slope protection was washed out. Between the Sacramento River and Chico on the same route, the south shoulder and portion of the pavement was washed out to a depth up to four feet for a distance of two miles by the overflow from Pine Creek and other streams. The cost of repairs on this route is estimated to be \$15,000.

BRIDGES WASHED OUT

East of Butte City, on State Highway Route 45, two bridges, totaling 240 feet in length, were washed away. One of these was over the Sacramento River Overflow Channel and the other over Big Butte Creek Overflow. Approaches to two other bridges and considerable road surfacing were lost on this same section. The damage was due primarily to flood waters which escaped from the Sacramento River. Nearly \$38,000 will be required to restore damaged road and structures on the 32 miles on this route, or an average of nearly \$1,200 per mile.

For the balance of the State highway routes in the Sacramento Valley, from the Shasta County line in the north to the Solano County line in the south, some \$15,000 will be required for repairs at scattered locations. This, of course, does not include cost of excessive repairs to road surfaces which will develop on many sections as a result of the inundation and saturation of the surface and subgrade.

There are occasional unusual accidents which incur heavy expense. A case in point is the damage to both trusses of the Douglas City Bridge across the Trinity River on Route 20. A gold dredge washed from its working pond some distance above the bridge, broke the lower chord of one truss, bent the same member of the second truss, and otherwise damaged the bridge before wrecking itself again a pier. The cost of repair of the bridge is estimated at \$50,000.

The estimates for restoration of road and structure damages include

an allowance for correction or protection work wherever it appears such work will prevent recurrence of the damage. Naturally, severe flooding of slopes and fills and excessive amounts of water in the soil caused failures at locations which appeared entirely safe. At other places, the possibility of damage was inherent in the construction.

TRAFFIC DEMANDS

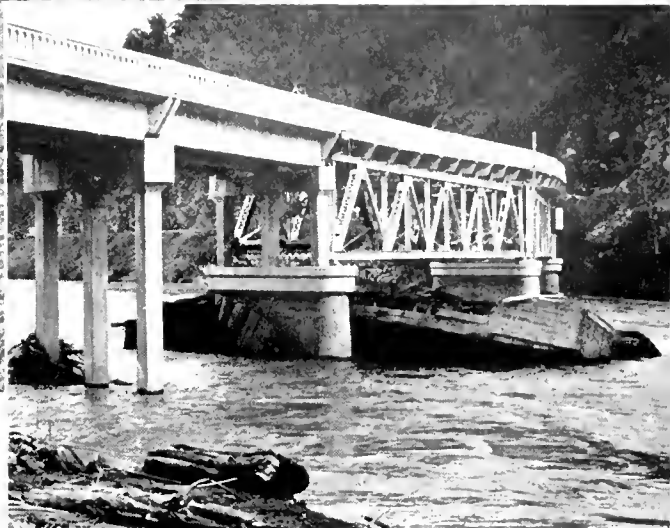
The demands of motor traffic for highways on high standards of alignment and grade have brought about construction of deep cuts and heavy fills. The most desirable locations in rugged country are usually immediately adjacent the major stream, and frequently are over unstable ground. In such circumstances the extent of measures at the time of construction to insure against slides or slipouts is debatable. Frequently, if full correction or protection were undertaken at the time of construction, the improvement could not be undertaken for lack of funds. More attention is constantly being given to doubtful situations prior to and during construction of new roads. The fact remains, however, that a certain amount of trial and error has been well justified in the past in work of this kind. It is more economical in the long run to suffer a certain amount of damage and inconvenience during the stabilization of cut slopes, for example, rather than expend the extra amounts required to flatten all slopes at the time of construction. It must be remembered, also, that experience of high water stages may be misleading.

FEATHER RIVER HIGHWAY

During the eight-year period that construction of the Feather River Highway was under way, there was no indication that the road would be endangered by high water. It was expected that heavy slides would develop during the weathering of the slopes, but the damage that occurred both in 1937 and 1940 could not reasonably have been guarded against. Once a heavy fill section has been lost by slipout the cost of correction is bound to be greater than any casual inspection would indicate. The simple



Flood-Damaged Highway Bridge across Trinity River near Douglas City.
Arrow points to weakened section.



This view shows wrecked dredger washed against bridge piers.

process of replacement of the fill is out of the question. The added load on the unstable foundation would only make future trouble more certain.

A case in point is the slipout on the Redwood Highway north of Cloverdale. Nearly 300 feet of the road settled 30 feet at this location. Before cost of correction can be estimated accurately or work undertaken, it is necessary to determine the elevation of the slippage plane and of firm ground. Well borings are now being taken for this purpose. If foundation material is found at any reasonable depth, the correction work will consist of removal of the overlying unstable material. Back-filling will consist of a layer of rock perhaps five feet in depth for the full width of the fill, including suitable drains. The fill can then be replaced with assurance that the road will not again slip out.

The financing of repair of damage such as occurred in both 1937-38 and the recent storm is a serious problem. All funds estimated to be available during a biennial period are budgeted well in advance and all programs of

work are planned accordingly. Reserves for slide removal and repair of storm damage are provided, but only on the basis of a normal year. A damage of one and one-quarter million dollars in a five-day period is beyond normal expectancy. Because of the location and nature of the damage this year, very little of the repair work can be deferred.

The Federal Government, in recognition of its responsibility in connection with the Federal Aid road system, has provided a fund to assist the States in financing repair of damage resulting from extraordinary storms. Their regulations restrict the use of such funds to replacement of fills and structures which may be washed away or destroyed, including correction and protection to prevent recurrence of the damage. Unfortunately, from the State's point of view, only a limited number of projects can qualify under these regulations, which include the further requirement that the State shall contribute at the same rate as on regular Federal Aid work. In California,

this rate is 42 per cent of the cost. The estimated cost of projects which qualify under the regulations is \$583,499. Even with Federal assistance, however, a very small reserve is available to carry on storm damage repair for the next fiscal year. It is evident that adjustments must ultimately be made in the program to provide further funds before the 1940-41 winter season.

The damage in the Sacramento Valley area has been described in some detail because of the very large flooded area. The damage in all areas is listed by routes in the accompanying tabulation. The estimates given are approximate, based on experience with similar work, pending opportunity to make surveys and study measures to be taken at the points of major damage. The amounts required may be increased or decreased when more complete detail is available.

Cost of Repairing and Replacing Highways and Bridges

Route	Limits	Slide removal	Type of Work		Total
			Bridge repairs or replacement	Replacement, washouts, slip- outs and other work	
District I—Eureka					
1	Sonoma Co. line to Oregon line.....	\$25,025	\$5,000	\$172,855	\$202,880
15	Jct. Route 1 to Colusa County line.....	7,175	-----	19,945	27,120
16	Hopland to Lakeport.....	7,000	-----	1,700	8,700
20	Arcata to White Bar Creek.....	2,000	-----	2,500	4,500
35	Alton to Peanut.....	4,000	-----	1,000	5,000
46	Weitchpec to Hamburg.....	-----	-----	2,000	2,000
48	Navarro River to Sonoma County line.....	5,250	-----	1,250	6,500
49	Sonoma County line to Jct. Route 15.....	800	-----	1,550	2,350
56	Sonoma County line to Westport.....	3,350	7,900	900	12,150
70	Ukiah to Talmadge.....	900	-----	200	1,100
81	Jct. Route 1 to Jct. Route 71.....	200	-----	-----	200
84	Willow Creek to Weitchpec.....	-----	-----	1,000	1,000
89	Middletown to Upper Lake.....	1,100	-----	5,900	7,000
Subtotals		\$56,800	\$12,900	\$210,800	\$280,500
District II—Redding					
3	Glenn County line to Oregon line.....	\$2,500	\$33,600	\$9,160	\$45,260
7	Glenn County line to Red Bluff.....	-----	-----	1,150	1,150
20	White Bar Creek to Millville.....	10,225	94,100	213,980	318,305
21	Jarbo Pass to Jct. Route 29.....	12,000	-----	68,550	80,550
28	Redding to Nevada State line.....	1,325	200	5,990	7,515
29	Peanut to Jct. Route 73.....	2,950	-----	5,110	8,060
35	Peanut to Douglas City.....	2,500	-----	2,500	5,000
46	Hamburg to Jct. Route 3.....	1,380	-----	50	1,430
47	Butte Co. line to Jct. Route 29.....	-----	-----	2,000	2,000
72	North of Weed.....	-----	-----	325	325
73	Jct. Route 29 to Oregon line.....	400	-----	2,675	3,075
82	Etna to Jct. Route 3.....	175	-----	-----	175
83	Jct. Route 21 to Jct. Route 29.....	4,700	-----	28,855	33,555
209	Shasta Dam to Jct. Route 3.....	-----	-----	1,000	1,000
Subtotals		\$38,155	\$127,900	\$341,345	\$507,400
District III—Marysville					
3	At Sacramento & N. of Biggs.....	-----	-----	\$600	\$600
6	Napa County line to Sacramento.....	-----	-----	5,000	5,000
7	Jct. Route 6 to Tehama Co. line.....	-----	-----	2,550	2,550
15	Lake County line to Williams.....	\$1,400	-----	650	2,050
17	At Wise Power House.....	290	-----	-----	290
11	Walnut Grove to Hood and Sportsman Hall to Strawberry	1,140	-----	1,600	2,740
21	Oroville to Jarbo Pass.....	1,500	-----	-----	1,500
25	Nevada City to Downieville.....	2,160	-----	-----	2,160
37	Colfax to Gold Run.....	75	-----	450	525
38	Near Floriston & Eagle Falls.....	750	-----	-----	750
45	Willows to Jct. Route 3.....	-----	\$15,200	2,900	18,100
47	Orland to Chico.....	-----	-----	15,300	*15,300
50	Jct. Route 15 to Sacramento.....	8,000	-----	30,750	38,750
65	Placerville to Auburn.....	225	-----	-----	225
83	North of Sierraville.....	-----	-----	300	300
87	Woodland to Oroville.....	-----	-----	1,660	1,660
88	Jct. Route 87 to Jct. Route 15.....	-----	-----	2,750	2,750
90	Winters to Madison.....	-----	-----	1,750	1,750
Subtotals		\$15,540	\$15,200	\$66,260	\$97,000
District IV—San Francisco					
1	Golden Gate Bridge to Mendocino County line..	\$6,000	-----	\$103,000	\$109,000
5	Santa Cruz to Los Gatos.....	5,000	-----	-----	5,000
	Hayward to Mountain House.....	2,500	-----	-----	2,500
6	Napa to Calistoga.....	4,500	-----	3,400	7,900
14	Richmond to Pinole.....	2,500	-----	5,000	7,500
32	Watsonville to Merced County line.....	5,250	-----	-----	5,250
42	Big Basin to Waterman Gap.....	2,700	-----	3,000	5,700
44	Boulder Creek to Big Basin.....	1,800	-----	-----	1,800
49	Calistoga to Lake County line.....	1,250	-----	-----	1,250
51	Sebastopol to Shellville.....	-----	-----	2,200	2,200
52	Alto to San Quentin.....	200	-----	-----	200

* Revised estimates for bridge replacements has increased this item to \$38,000.

aged During February Storms Will Amount to \$1,267,200

Route	Limits	Slide removal	Type of Work		Total
			Bridge repairs or replacement	Replacement, washouts, slip- outs and other work	
District IV—San Francisco—Continued					
55	South of Saratoga Gap.....	-----	-----	\$500	\$500
56	Watsonville to Sonoma County Line.....	\$17,000	\$1,000	70,700	88,700
56	Jenner to Mendocino County line.....	5,750	2,000	5,000	12,750
67	Watsonville to Monterey County line.....	1,500	-----	-----	1,500
68	At Brisbane and Francisquito Creek.....	12,000	-----	1,000	13,000
69	San Quentin to San Rafael.....	100	-----	600	700
102	Rutherford to Jct. Route 6.....	4,500	-----	-----	4,500
103	Geyserville to Calistoga.....	1,000	-----	400	1,400
104	Jenner to Shellville.....	8,650	-----	32,000	40,650
105	Half Moon Bay to San Mateo.....	400	-----	-----	400
106	Pinole to Martinez.....	2,500	2,000	-----	4,500
107	Dublin to Sunol.....	500	-----	-----	500
108	Mission San Jose to Livermore.....	1,000	-----	-----	1,000
116	Santa Cruz to Waterman Gap.....	11,600	-----	-----	11,600
Subtotals		\$98,200	\$5,000	\$226,800	\$330,000
District X—Stockton					
7	Vallejo to Yolo County line.....	\$6,000	-----	\$1,500	\$7,500
8	Napa County line to Cordelia.....	500	-----	-----	500
53	Rio Vista to Suisun.....	-----	-----	300	300
74	Benicia to Vallejo.....	300	-----	-----	300
90	Vacaville to Yolo County line.....	-----	-----	1,000	1,000
99	Rio Vista to Ryer Island Ferry.....	-----	-----	27,000	27,000
101	Jct. Route 53 to Dixon.....	-----	-----	1,000	1,000
208	Black Point to Vallejo.....	-----	-----	500	500
65	Amador County line to Tuolumne County line.....	600	-----	-----	600
65 & 13	Vicinity of Sonora.....	600	-----	-----	600
65 & 40	Vicinity of Groveland.....	2,500	-----	-----	2,500
18	Merced to Yosemite Nat'l Pk.....	7,000	-----	-----	7,000
4 & 5	San Joaquin and Stanislaus Counties.....	-----	-----	3,000	3,000
23 & 24	In Alpine County.....	500	-----	-----	500
Subtotals		\$18,000	-----	\$34,300	\$52,300

COMPLIMENT FROM NEVADA

State of Nevada
Department of Highways
Division of Traffic and Safety
Carson City, Nevada

Department of Public Works,
Sacramento, California.
Attention: John W. Howe, Editor.

Dear Sir:

We have just received the two copies of your January issue of "California Highways and Public Works." Needless to say, the writer, as well as others in the Traffic and Safety Division, has consistently admired the way in which this publication is issued and we consider it a privilege to be included on your permanent mailing list.

Again thanking you for the courtesy extended, we remain

Sincerely yours,

ROBERT A. ALLEN,
State Highway Engineer.

By: (Signed)

BERNARD C. HARTUNG,
Director Traffic and Safety Division.

Beauty Preserved

The outdoor advertising companies of Austin have agreed to preserve the scenic beauties of the drives along the Colorado River. The companies agreed not to erect any signs of any description along the many miles of road leading from Austin to the Marshall Ford Dam so that the beauty of the countryside will not be marred. The agreement was made voluntarily by the companies. The absence of signs should make Austin's scenic drives among the most beautiful in the state.—*Texas Parade.*

Small Boy—Daddy was run into by an automobile and he wants to know if you'll let him have groceries on credit?

Grocer—Has he got a good lawyer?

Mike was smoking in the waiting room of a railway station. A porter said to him: "Don't you see that notice on the wall: 'No Smoking Allowed?'"

"Yes, I do," answered Mike, "but how can I kape all the rules? There's another sign on the wall, 'Wear Beauty Corsets.'"—*The Tennessee Road Builder.*

APPRECIATES MAGAZINE

Los Angeles, Calif.

March 21, 1940

Editor California Highways
and Public Works,
Sacramento, California.

Dear Sir:

Will you please continue sending me your Official Journal of the Division of Highways and Public Works. I have found much valuable information in this publication relative to our great highway system and some of the problems encountered by your Department to make our great state one of the easiest to travel in.

If more of our citizens knew more about how much your department accomplishes for the good of the state there would be less "crabbing" about the taxes they are asked to pay. Thank you for last year's issues.

R. HAASE,
3935½ La Salle Ave.,
Los Angeles, Calif.

"With a single stroke of a brush," said the school teacher taking his class around the art gallery, "Joshua Reynolds could change a smiling face to a frowning one."

"So can my mother," said small Willie.

"Burning of the Minnie A. Caine"

(Continued from page 17)

between it and the shore. The craft and the sand bar then acted as a groyne, and early in December, 1939, heavy swells accompanying high tides caused the waves to start battering and cutting into the highway embankment for a distance of approximately seven hundred feet. Cutting action continued for four days, and decreased only after five hundred tons of rip rap had been placed at the toe of the slope, but almost four thousand cubic yards of berm and shoulder had already been washed out to sea.

A study of the wave action during high tides indicated very clearly that the ocean swells striking along the port side of the ship diverted the water and caused a concentration of wave action at the point where the highway was being damaged. It was then realized that the ship was a serious menace to the highway, and should the high tides, which were forecast to recur about the last of December, be accompanied by a strong wind, the entire highway would be threatened at that point. Immediate steps were taken to have the menace removed.

BOAT SET AFIRE

It was decided that the most satisfactory way to dispose of the boat under the circumstances was by burning. The matter was discussed with Captain Olson. His approval was secured, and he offered to cooperate with the Division of Highways maintenance forces. As soon as abandonment papers had been filed by Captain Olson, and the necessary permits secured from several agencies, final arrangements were made for the conflagration.

Weather service bureaus were consulted, and they advised that conditions would be most favorable for burning on the night of December 21, 1939, when an off shore breeze would be blowing. Plans were therefore laid for the burning at that time, and during the evening six hundred gallons of fuel oil and gasoline were



While "Minnie A. Caine" was forming sand bar, tidal currents threatened highway.

spread over the boat. By 1 a.m. everything was in readiness for the blaze. All cars and onlookers were cleared from the highway for a distance of two hundred yards each way, and a gasoline soaked rope which had been laid over the deck and out across the sand bar was ignited. There was no explosion, and the flames spread over the boat very slowly. By daylight the deck and a portion of the stern had burned, but the hull was not much more than charred.

BEACH LINE RESTORED

As it became evident during the morning that if more oil was not added, the flame would soon go out, leaving the hull still in a position to continue to deflect the surf and cause further erosion, additional quantities of the fuel were rushed and pumped into the ship that afternoon. This time, fifty-four hundred gallons of crude oil were fed to the flames, it immediately ignited, and in a few minutes the hull was burning rapidly. The heat was terrific, but the hull which was twenty-seven inches thick was also water-soaked, and in order that the burning would be complete,

another twenty-eight hundred gallons of oil was ordered, and pumped into the fire later that day. The following morning, the ship was burned to the sand line, leaving only the keel and a small portion of the hull below the water. What fire remained was quenched as soon as the tide came in, but the fire had now done its work. The days of the once proud and sturdy "Minnie A. Caine" had come to an end.

The waves of the incoming tide washed the sand from within and around the keel, and it started to float. This allowed the shore currents to work on the offending sand bar, and in three days it was entirely removed. The keel by that time was washed up to within thirty-five feet of the roadway embankment to a point where it was no longer a menace. With these obstructions removed, it was only a few days more before the eroded beach was rebuilt to normal by the addition of almost four feet of sand, and the task was then considered successfully completed.

This work was done in District VII, in which S. V. Cortelyou is the District Engineer.

The Evolution of Cement

(Continued from page 12)

mate mixture of chalk and clay. This, being the first attempt to modify or control the composition of the raw material, might be considered as the principle forerunner of the manufacture of portland cement.

ASPDIN INVENTS PORTLAND CEMENT

In 1824, Joseph Aspdin, a Leeds, England, builder, was granted a patent for his process which consisted of calcining a mixture of quick lime and clay in a lime kiln, and crushing the resulting lumps into a fine powder. He used a much lower temperature than is now used, and his product must have been of an inferior quality.

Aspdin is usually credited with the invention of portland cement, a product which he named "Portland Cement," because it resembled the stone from the famous quarries at Portland, England.

Some time after this, Isaac Charles Johnson, another Englishman, observed that the ground overburned lumps in kilns, previously discarded, made much better cement than the usual product, although it was slow setting. Using these nodules as a basis for study, he found the correct proportions of limestone and clay to use for a higher type cement. In 1851 he took over the old deserted Aspdin plant, where he began to manufacture portland cement.

RECENT IMPROVEMENTS

It would appear that Johnson was the first to recognize the importance of the chemical composition of the raw material, and of the higher temperatures necessary for actual clinking of the material. Basically his cements were very similar to those now used. The more recent improvements have been along the line of refinements in processes, the uniformity of products, and the modification of the chemical composition to meet special conditions.

Portland cement is defined as "the product obtained by finely pulverizing clinker produced by calcining to incipient fusion an intimate and properly proportioned

Job Well Done

Throughout the "plague of waters" central and northern California has been suffering for the last week or so, two State departments have rendered outstanding service to the public.

They are the Highway Department and the Highway Patrol. Long hours, strenuous work under the most difficult conditions have meant nothing to the men of these two departments in their successful efforts to keep the highway open and **SAFE** for travel.

Except where the floods have entirely blotted out the roads, traffic, even in the stricken areas, has been kept moving in splendid fashion.

Orchids to both the patrol and the highway departments. They deserve 'em.

—*San Francisco Call-Bulletin.*

mixture of argillaceous and calcareous material, with no additions subsequent to calcination excepting water and calcined or uncalcined gypsum."

It is the purpose of this paper to unravel the above definition, and to put it in terms readily understandable by those not intimately concerned with the manufacturing of cement.

The manufacturing of cement starts at the quarries where the raw materials are found. These raw materials are of two types: (a) Calcareous, or those rich in calcium carbonate such as limestone, marl, or chalk, and (b) argillaceous, or those high in alumina, iron oxide and silica, such as clay, shale, slate, or slag. The proportions that are taken of these materials depends entirely upon their chemical composition being usually in the ratio of approximately 80 per cent lime to 20 per cent clay or shale. Occasionally a cement rock

is found in which occur all of the elements necessary for cement. In such cases, only small additions are made to insure a product of uniform composition.

CALIFORNIA DEPOSITS

The raw materials in the quarries vary greatly with the location. In California the lime quarries vary from great deposits of nearly pure calcite to deposits of oyster shells under sea water. In any form they are all great storehouses of calcium carbonate (CaCO_3).

For the economical manufacture of cement, the quarry must be within an economical hauling distance for the mill, and the mill must be near a railroad.

Each company develops its own most suitable method of winning the material from the quarry. This varies from the "glory hole" method of mining, where the rock is blasted from the sides of the quarry to fall into great rock chambers, from whence it is gravity loaded into railway cars or trucks in tunnels underneath, to the barge hauling of material dredged from under water. One company mines its material from underground by the "block cave" method of mining. Another used endless belts to transport the raw material from the quarry to the mill. The most decisive factor in choosing the method of mining and of transportation is that of getting the material from the quarry to the mill at the least possible cost per ton.

WET AND DRY MIX PROCESSES

Once the raw material is at the mill, it is passed through crushers and various types of grinders which rapidly reduce it to a powder after which it is stored in bins.

There are two processes in use from this stage, the "dry mix" process, and the "wet mix" process. As the "wet mix" is slowly replacing the former type, perhaps it would be better to describe the "wet mix." The two methods differ essentially in the final stages of the raw material grinding, and the length of the kiln, it being nec-

(Continued on page 29)

Lodi-Rio Vista Cut-off Will Be Mileage Saving

(Continued from page 16)

the Mokelumne River Bridge can be eliminated at a considerable saving in cost.

The laboratory under day-labor authorization has now completed the sand drains and the placing of certain equipment to record the progressive settlement of the fill, water pressure, etc.

A contract has been awarded to Mike Malfitano & Son of Pittsburg for placing 40,000 cubic yards of fill, which will be barged to the site and placed for a distance of about 3100 feet west of the bridge.

The special provisions for this contract provide among other things that the embankment nearest the bridge be done first, but the right is reserved to suspend the placing of embankment materials here when so ordered for a period not to exceed 12 days. During this time embankment materials may be placed on the west-
 erly part of the job.

It is also provided that not over 500 cubic yards of embankment be placed in any 24-hour period and that the rate of placing shall not exceed 100 cubic yards per hour. Also after the first layer one foot in depth is placed all subsequent layers shall not be over four inches in depth. The reason for these stringent regulations is to prevent, if possible, the side displacement of the soil under the fill such as occurred during the construction of the east approach, several years ago.

The 30-inch vertical sand drains were placed in the easterly 1000 feet of the project, spaced on 10-foot centers, each alternate row staggered. They are approximately 25 feet in depth.

The completion of this entire project will be delayed until the results of this test section are known, as the length of the approach trestle to the new bridge planned over the Mokelumne River and the west approach to the existing Potato Slough Bridge and the height of the fill on the balance of the project will depend upon the results of this test.

The project when completed will shorten the distance from U. S. 99

In Memoriam Harold Emil von Bergen

Harold Emil von Bergen was born in Petersburg, Nebraska, on July 7, 1904, the son of J. E. and Anna Schultz von Bergen.

He received his elementary and high school education in the public schools in the State of Nebraska; came to California after graduation from high school in 1924 and worked for a year in pipe line maintenance with the Pacific Gasoline Company in Taft. He entered Oregon State College in 1925, graduating therefrom with the class of 1929 with the degree of Bachelor of Science in civil engineering. He affiliated with Theta Chi social fraternity in college.

After graduation from Oregon State College, Mr. von Bergen was employed for nine months by the Reclamation Commission of the State of Oregon on drafting and dam analysis. He returned to California in March, 1930, and accepted a position as Junior Engineer of Hydraulic Structural Design with the Division of Water Resources, Department of Public Works, State of California, in connection with the administration of the recently enacted Act Governing the Supervision of Dams. He left the Division of Water Resources in July, 1933, and took a position with the U. S. Forest Service at Quincy, California, as chief of a surveying party, returning to the Division of Water Resources in March, 1935, as Water Master on the Pit River stream system.

Mr. von Bergen was a man of strong physique and gloried in the outdoor functions of his work. His untimely demise was due to accidental death in the line of duty by drowning when a boat capsized last February 28 while he was making a measurement of emergency flood flow in the Sacramento By-Pass.

Mr. von Bergen was married in Reno, Nevada, on April 1, 1934, to Frances Evelyn Rooney of Sacramento. He is survived by his widow and his daughter, Della Ann von Bergen, both of Sacramento, his mother, Anna S. von Bergen, five sisters, Alice von Bergen, Mrs. Katherine Oblman, Mrs. Grace Jensen, Mrs. Elizabeth Phillips, and Mrs. Clara Meyers, and two brothers, Arthur and Max.

Harold Emil von Bergen was elected a Junior Member of the American Society of Civil Engineers on July 14, 1930, and in 1936 was elected an Associate Member.

near Lodi 11.1 miles and will shorten the distance from Stockton 12.7 miles. The ultimate project with a proposed county road change near Stockton will shorten the distance from Stockton to Rio Vista 14.7 miles.

Construction on Coast Highway is Under Way

(Continued from page 10)

vide sufficient width for the new alignment. The embankment has also been raised 18 feet above the old road at this location and widened to allow the new standard width.

At Latigo Creek, to provide drainage under the highway embankment, a 7 by 9-foot reinforced concrete arch 213 feet long has been constructed.

CENTER DIVIDING STRIP FOUR FEET
WIDE

This contract calls for the construction of a divided roadway having a four-foot central longitudinal division strip with two lanes of traffic on each side. This four-foot wide central dividing strip will be constructed of portland cement concrete curbs which are five feet high and have a 1½:1 slope. In the center between the curbs there will be placed one-foot of top soil, 27 feet wide, in which ice plants will be planted at a later date.

There will be a 11-foot wide pavement lane next to and on each side of the center strip which has four feet of plant mix surfacing on top of a foot of selected material. On each side of the center and just outside the above mentioned lane there will be constructed Portland cement concrete lanes 11 feet wide of standard thickness.

TO BE COMPLETED DECEMBER 1940

John Strona, who submitted a low bid of \$245,786.80, is the contractor on this job. Mr. C. N. Ainley is the Resident Engineer in charge of construction on this contract. At the present rate of construction work will be completed by December 1, 1940, which is within the allotted contract time.

Mose was trying to describe to his friend the kind of fish he had caught. "I tell you," he exclaimed, "it was that long! I never saw such a fish in my life!"

"I believe you," answered his friend.

"Are you a good carpenter?"

"Yes."

"Then how do you make a Venetian blind?"

"You stick your finger in his eye."

The Evolution of Cement

(Continued from page 27)

essary to use a long kiln for the "wet mix" due to the large amount of water to be evaporated before the temperature of the material can be raised to temperature necessary for clinkering. The chemistry of the two types is the same.

In the "wet mix" the raw materials, after being reduced to a powder, are mixed in a stream of water, and passed through a tube mill where the clay and the limestone, proportioned by analysis, are thoroughly mixed, and pulverized by the countless impacts of heavy steel balls falling in a revolving steel tube. The material flows out of this mill as a slurry containing from 30 per cent to 40 per cent of water. It is then conveyed into large blending tanks, in which the material is mixed and kept in suspension with large revolving rakes, and compressed air bubbling up through the mass.

CHEMICAL ANALYSIS MADE

Chemical analysis is made of the many such storage tanks. From the figures thus obtained a mixture is made from the various tanks, which, when burned in the kiln, will give a product of the desired analysis. This mixture is then pumped into storage tanks from which it is fed in measured amounts into the kiln where it is burned into cement clinker.

The kiln itself is a riveted steel cylinder that varies in length from 60 to 100 feet for the "dry mix" plants to over 500 feet for the "wet mix" plants, and from 6 to 15 feet in diameter. The lower or discharge end of the kiln is lined with a highly refractory material to protect it from the blast of the flame. Higher up, because of the much lower temperatures, fire brick is used as a liner. The kiln has a pitch, or drop of three-quarters of an inch per foot of length. It revolves very slowly upon large steel trunnions being driven by an electric motor connected through reducing gears to a great ring gear that encircles the kiln. The material or slurry to be burned enters the kiln at

A Citation

County of San Mateo
Redwood City

April 1, 1940.

Mr. Frank W. Clark,
Director of Public Works,
Sacramento, Calif.

Dear Mr. Clark:

During the recent heavy storms there was a great deal of damage done to the State highways in this county, but due to the efforts of Mr. William Holbrook, in charge of maintenance in this vicinity, immediate repairs were made and traffic delays were reduced to a minimum.

I wish to highly compliment Mr. Holbrook on the efficient manner in which this repair work was done.

Very truly yours,

Frederick Peterson,
County Executive.

the upper end, while the oil or gas for the burning is introduced under pressure at the lower end creating a tremendous heat, and a stream of hot gases that flow in the opposite direction to the flow of the raw material. As the kiln revolves, the raw mix slowly travels downward from the point of entry to the lower end of the kiln where it emerges as a granular material known as cement clinker. It is the chemical processes that take place in this kiln under the high temperatures that convert the mechanical mixture of limestone and clay into the clinker which subsequently becomes portland cement after being finely ground.

This is the first installment of Mr. Meder's article on cement. The second will appear in a later issue.—Ed.

The decrepit old car rolled up to the toll bridge.

"Fifty cents," called out the gateman.

"Sold," replied the driver.

Flood Lesson

The Sacramento Valley flood should not pass without emphasis being put upon the lesson it teaches.

If it were possible to total up all the millions of dollars worth of damage this "Ol' Man River" has done since civilization came into its broad valley we are sure the amount would vastly exceed the 170 million dollars which is being spent now to control it.

When the Central Valley Project is completed disastrous floods like the present one will be a thing of the past. Waters will be caught behind the gigantic Shasta Dam and held for beneficial release as needed for irrigation and power. Excess waters, instead of flowing uselessly out to sea, will be shunted into the lower San Joaquin Valley to augment the lesser supply of the San Joaquin River.

In brief, this great inland drainage system will be harnessed and controlled to serve social needs instead of being permitted to continue as a menace to life and property.

The cost of doing it is great, yes, but only initially. Over the long range it will be returned to the people again and again.

So, the lesson of the flood is that man need not necessarily continue to be a helpless victim of unruly nature.

—San Francisco News.

REQUEST FROM MODESTO

STANISLAUS COUNTY SCHOOLS

Modesto, California

March 29, 1940

Editor California Highways
and Public Works,
Sacramento, California.

Dear Sir:

I recently had the pleasure of seeing and reading several of your little magazines "California Highways and Public Works" and was very interested in the type of material presented in them, particularly the pictures used. It is of a type we are anxious to obtain for our Visual Department, to be used both as general reference material and also, if possible, to re-photograph the pictures and make slides of them.

I understand the magazine is sent when requested and if this is so, I would greatly appreciate being put on your mailing list. Also, if back numbers are available, I would be glad to get all possible.

Yours very truly,

B. W. GRIPENSTRAW,
Supervisor Visual Education.

New Survey of Flood Control Project Needed

(Continued from page 11)

and the river capacity from this point south to Tisdale Weir is 72,000 second-feet.

Below the confluence of Butte Slough and the Sacramento River the excess water from the Butte Basin flows into the upper reaches of the Sutter By-pass. The by-pass here is designed to carry 178,000 second-feet of water. It is 4,000 feet wide at the upper end and confined between levees 18 to 20 feet high.

TISDALE WEIR

The Tisdale Weir which is located approximately half way between Colusa and Knights Landing is 1,150 feet wide and begins to overflow when the river reaches a stage of 18 feet (Colusa gage). Excess water from the Tisdale Weir flows into the Tisdale By-pass, an artificial channel 1,000 feet wide and 4.4 miles long. It crosses the Sutter Basin and empties into the Sutter By-pass. It has a capacity of 38,500 second-feet and consequently the capacity of the Sutter By-pass from its junction with the Tisdale By-pass to Nelson Bend where excess water from the Feather River flows into the by-pass is 216,500 second-feet. From Nelson Bend to Fremont Weir where the by-pass system crosses the Sacramento River, the Sutter By-pass is 7,000 feet wide and has a capacity of 416,500 second-feet. The Sacramento River reduced by the outflow through the Tisdale Weir is designed to carry only 33,500 second-feet from Tisdale to Fremont Weir which is located several miles below Knights Landing.

FREMONT WEIR

The Fremont Weir is located in the south levee of the Sacramento River. It is 9,120 feet long and will carry 343,000 second-feet of water. It provides one of the complicated and sometimes confusing features of the by-pass system, for here water which has come down the Sutter By-pass flows into one side of the Sacramento River and out again on the other side. Meanwhile the Sacramento River between levees of increased size is capable of carrying 107,000 second-feet from its junction with the Feather River about a mile below Fremont Weir down to the Sacramento Weir



This debris, washed up against Sutter By-pass levee, is all that remained of several farm structures after February floods.

which is located just above the confluence of the Sacramento and American rivers, north of the city of Sacramento. From the point where the by-pass system crosses the Sacramento River southward, it is called the Yolo By-pass. It is 8,000 to 13,000 feet wide in the portions having levees on each side and much wider in the lower reaches. Levees range in height from 15 to 20 feet with 6 feet free-board. The capacity of the Yolo By-pass at the upper end is 362,000 second-feet down to the Sacramento By-pass.

An interesting feature of the plan is the Sacramento Weir and By-pass which transports Sacramento and American River flood waters into the Yolo By-pass. The Sacramento Weir, which is 2,000 feet long, is the only one of the five which has gates. The direction of the flow in the Sacramento River between the mouth of the American River and the Sacramento Weir is reversed when flood waters from the American River make it necessary to open the gates on the Sacramento Weir while the

flow from the upper river is comparatively low. The gates of the Sacramento Weir are opened by order of the State Engineer when the river reaches a 28.5' stage on the Sacramento River, I Street gage. The by-pass from the weir to the Yolo By-pass is two miles long and has a capacity of 112,000 second-feet.

BY-PASS SYSTEM

Below the confluence of the Sacramento By-pass and the Yolo By-pass, the latter is designed to carry 480,000 second-feet down to where Putah Creek empties into the by-pass from the west where the capacity is increased to 490,000 second-feet. From that point down to where the by-pass system again empties into the Sacramento River near Rio Vista the capacity is 500,000 second-feet.

In recent floods it was clearly demonstrated that the Sacramento Flood Control Project functions effectively as designed. However, the project was created on data collected during the flood of 1907 and several steps must be taken to remedy weaknesses

which were evident in the recent floods.

RESURVEY RECOMMENDED

In a report to Governor Culbert L. Olson on the recent flood it was recommended that a complete resurvey of the Sacramento Flood Control Project be made at once to determine the necessary modifications in the plans for the existing project. The report said:

"At many points in the upper valley floods reached unprecedented heights and at some points exceeded designed project capacities. While the levee failures were in uncompleted sections, question has been raised as to the adequacy of the project when complete, to protect the valley against floods of equal or greater intensity. Greater security by higher levees or additional by-passes has been suggested.

"No permanent solution of the recurrent problems of disastrous floods is possible unless plans for adequate flood protection are formulated and a means found for the construction of flood control works. The importance and necessity of legislation to authorize studies and the preparation of plans for flood control, and the appropriation of funds therefor, is evident. The cooperation of the State with the Federal agencies and local interests is necessary in order to work out the best plan and program for flood control in combination with water conservation and utilization.

"In addition to the necessity of planning and constructing adequate works for flood control, it is essential that provision be made for the proper management, operation and maintenance of flood control works which now exist or may hereafter be constructed. It appears evident that the failure of flood control works during the floods of recent years has been due, in many cases, to lack of proper management, maintenance and operation or at least insufficient activities with respect thereto. It is essential that the responsibility for the proper operation and maintenance of flood control works and the financing thereof be definitely fixed and regulated as may be found necessary.

"In the case of comprehensive projects for flood control such as the Sacramento Flood Control Project, it appears essential that the respon-

Bay Bridge Painting Problems

(Continued from page 19)

prior to painting with a portable steam cleaning unit. This equipment is similar to, and probably more familiar as, the steam cleaning machine used in garages and other industrial plants for cleaning greases, oils, etc., from car chassis and engines. It is essentially a boiler with a flash-type heating coil generating low pressure steam. Hot water mixed with the steam in the heating coils acquires considerable velocity by virtue of the steam pressure and is directed by means of a hose and suitable atomizing nozzle upon the work to be cleaned.

Addition of a small percentage of suitable solvent expedites the removal of soil film even though it be cemented with road oils and grease. The solvent must be formulated to be noninjurious to the paint film in the proportions used. An excellent feature of this cleaning method is the lack of abrasion and removal of film which is otherwise in good condition.

So satisfactory has the first unit been that two more have recently been ordered for early delivery. It is believed that the use of equipment of this type is an innovation in bridge maintenance.

With some 15,000,000 square feet of steel surface to maintain, it is

sibility for the management, maintenance and operation of the project works be confined to a single agency. Under the present situation with responsibility for maintenance and operation resting among numerous agencies comprising the local districts and the State Department of Public Works, the successful functioning of the Sacramento River Flood Control Project works as designed is rendered uncertain. To avoid failure and assure adequate and efficient operation and maintenance of such a project, control should be centered in one agency and such agency should be furnished with ample authority and funds for the purpose."

anticipated that work will be so scheduled as to cover most of this area on a five-year cycle. Due to location, some surfaces will furnish a longer life while a small percentage may require more frequent attention. The scheme of maintenance contemplates correction of paint film failure in its initial stages before attack has occurred on the steel surface. It is felt that this procedure will result in the lowest ultimate cost.

From the start of operations on October 1, 1937, to June 30, 1939, a total of 5,046 gallons of paint had been used. For the six months, June 30, 1939, to December 31, 1939, the gallonage was 3,913, indicating an acceleration of operation. Of the 3,913 gallons, 1,683 were red lead in oil; 1,850, aluminum; and the remainder of miscellaneous formulae.

Maintenance cost on painting in the fiscal year ending June 30, 1939, was \$61,360.50. For the fiscal year ending June 30, 1940, the sum of \$118,880 has been budgeted.

The San Francisco-Oakland Bay Bridge is maintained and operated for the California Toll Bridge Authority by the Division of Highways of the Department of Public Works. Governor Culbert L. Olson is chairman of the Toll Bridge Authority; Frank W. Clark is Director of Public Works; C. H. Purcell is State Highway Engineer, and Ralph A. Tudor, Principal Bridge Engineer in charge of maintenance and operation on the bridge.

State Speeds Program to Restore Levees

(Continued from page 4)

February 28 at Kennett could have reduced to 23,000 second feet below Shasta Dam and that the peak discharge at Red Bluff of 291,000 second feet on the same date could have been reduced to 125,000 second feet.

Thus, instead of having a peak stage of 32.2 feet at Red Bluff the flow would have been reduced to 24.5 feet and held at that stage for the duration of the storm. Such regulation of the river would have largely eliminated flood damage to Shasta County, which was estimated at \$685,200 and materially reduced the flood damage in Tehama County, which was estimated at \$378,200. This flattening out of the peak flow of the river also would have resulted in a consequent

lessening of the strain on the levee system in the section between Jacinto and Princeton, where the largest number of breaks occurred.

The following table shows the estimated effect of the operation of Shasta Reservoir for flood control on Sacramento River flows during the flood of February-March, 1940.

Below Shasta Dam			
Date	Actual mean daily flow, in second-feet (1)	Mean daily controlled flow, in second-feet	Change in flow, in second-feet (2)
Feb. 27-----	120,000	95,000	— 25,000
28-----	159,000	23,000	—136,000
	(182,000 peak)		
29-----	89,200	36,200	— 53,000
March 1-----	56,200	83,900	+ 27,700
2-----	41,300	96,800	+ 55,500
3-----	31,700	102,500	+ 70,800
4-----	25,900	46,800	+ 20,900

At Red Bluff			
Date	Actual mean daily flow, in second-feet (1)	Controlled flow, in second-feet	Change in flow, in second-feet (2)
Feb. 27-----	150,000	125,000	— 25,000
28-----	261,000	125,000	—136,000
	(291,000 peak)	125,000	—167,000
29-----	178,000	125,000	— 53,000
March 1-----	97,300	125,000	+ 27,700
2-----	69,500	125,000	+ 55,500
3-----	54,200	125,000	+ 70,800
4-----	43,900	64,800	+ 20,900

- (1) Assuming flow at dam same as at Kennett gaging station.
 (2) Minus sign indicates decrease in flow.
 Plus sign indicates increase in flow.

State Office Building

(Continued from page 13)

ization from State agencies and from the various contractors, which is so vitally necessary for success in such an undertaking.

In turning this modern office structure over for occupancy and maintenance we hope we have accomplished the original desire, to have this building represent a pleasing and adequate addition to the Sacramento State buildings.

Prof: We have only a few minutes left. I should like to have someone ask me a question that is bothering him.

Stude: What time is it, sir?

Highway Bids and Awards for the Month of March, 1940

CALAVERAS, STANISLAUS, TUOLUMNE AND AMADOR COUNTIES—Furnishing and applying Diesel oil to 165.3 miles of roadside vegetation. District X, Oilfields Trucking Co., Bakersfield, \$3,149; Lee J. Immel, Berkeley, \$3,348; Close Building Supply, Hayward, \$2,901; Pacific Truck Service, Inc., San Jose, \$3,856. Contract awarded to Sheldon Oil Co., Suisun, \$2,467.

INYO COUNTY—At Panamint Springs 1.12 miles grading and roadmix surface treatment. District IX, Route 127, Sections F & G. A. S. Vinnell Co., Alhambra, Calif., \$8,129; Basich Bros., Torrance, \$9,126; Santa Barbara Crane Serv., Santa Barbara, \$9,979; Ishell Cons. Co., Reno, Nev., \$11,313; Silva & Hill Cons. Co., Glendale, \$11,470. Contract awarded to Geo. E. France, Visalia, \$7,928.

LOS ANGELES COUNTY—Two undercrossings to be constructed, one a joint crossing under the tracks of the A. T. & S. P. Ry and the U. P. R. R. and the other under Fremont Avenue in South Pasadena; and the grading of a portion of Arroyo Seco Parkway and reconstructing Grevelia Street and Fremont Avenue. District VII, Route 205, Sec. 8, Pas. Dimmitt & Taylor, Los Angeles, \$136,683; Carlo Bongiovanni, Los Angeles, \$137,597; R. M. Price, Huntington Park, \$138,301; Byerts & Dunn, Los Angeles, \$142,175; Claude Fisher Co., Ltd., Los Angeles, \$143,617; Person & Hollingsworth Co., Los Angeles, \$144,487; Griffith Co., Los Angeles, \$146,616; Sordal & Bishop, Long Beach, \$155,562. Contract awarded to Oscar Oberg, Los Angeles, \$135,684.

MERCED, MARIPOSA AND STANISLAUS COUNTIES—Furnishing and applying Diesel oil to 133.2 miles of roadside vegetation. District X, various locations. Claude C. Wood, Lodi, \$2,222; Oilfields Trucking Co., Bakersfield, \$2,484; Pacific Truck Service, Inc., San Jose, \$3,019; Lee J. Immel, Berkeley, \$2,494; Close Building Supply, Hayward, \$2,242. Contract awarded to Sheldon Oil Co., Suisun, \$2,211.

MODOC COUNTY—Between 4 miles north of Lake City and Fort Bidwell about 10.9 miles in length to be graded and surfaced with road-mix surfacing. District II, Feeder, Louis Biasotti & Son, Stockton, \$80,022; Ishell Const. Co., Reno, Nev., \$80,847; The Utah Const. Co., San Francisco, \$80,981; Harms Bros. & N. M. Ball Sons, Berkeley, \$81,156; Lee J. Immel, Berkeley, \$81,695; Claude C. Wood, Lodi, \$84,483; Parish Bros. & Brighton Sand & Gravel Co., Sacramento, \$86,686; Frederickson & Westbrook, Sacramento, \$89,710; Guerin Bros., San Francisco, \$93,064; Oilfields Trucking Co., Bakersfield, \$96,727. Contract awarded to Poulos & McEwen, Sacramento, \$77,482.50.

RIVERSIDE COUNTY—Between three miles west of Blythe and Ash Street in Blythe, about 3.2 miles to be graded and road-mix surface treatment applied. District XI, Route 64, Sections E, Bly. G. W. Ellis, North Hollywood, \$54,492; A. S. Vinnell Co., Alhambra, \$55,268; E. L. Yeager, Riverside, \$58,251; Warren Southwest, Inc., Los Angeles, \$58,489; Valley Construction Co., San Jose, \$59,832; Oswald Bros., Los Angeles, \$60,611; Denni Investment Corp., Wilmington, \$75,400. Contract awarded to Daley Corp., San Diego, \$53,033.

SAN JOAQUIN COUNTY—West of Little Potato Slough Bridge at Terminous, about 0.6 mile in length, highway embankment to be constructed. District X, Route 53, Section C. Basalt Rock Co., Inc., Napa,

\$29,200; J. R. Reeves, Sacramento, \$36,000; Claude C. Wood, Lodi, \$37,200; Marshall S. Hanrahan, Merced, \$39,520. Contract awarded to Mike Malfitano & Son, Pittsburg, \$27,760.

SANTA CLARA COUNTY—Between Saratoga and Los Gatos, about 1.4 miles in length, to be graded and surfaced with plant mixed surfacing on gravel base. District IV, Route 42, Section 4. Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, \$69,556; Piazza and Huntley, San Jose, \$69,872. Contract awarded to Caputo & Keeble, San Jose, \$61,720.25.

SHASTA COUNTY—About one-half mile East of Redding, repair Bridge 26-41 across Sacramento River. District II, Route 20, Section C. Clifford A. Dunn, Klamath Falls, Ore., \$17,414; Lord & Bishop, Sacramento, \$23,460; M. A. Jenkins, Sacramento, \$15,280; J. P. Brennan, Redding, \$20,833. Contract awarded to Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, \$15,090.

SISKIYOU COUNTY—Between Bailey Hill and Oregon State line, about 1.8 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District II, Route 3, Section C. Claude C. Wood, Lodi, \$125,531; Maceo Construction Co., Clearwater, \$127,176; Frederickson and Westbrook, Sacramento, \$131,380; A. Teichert & Son, Inc., Sacramento, \$131,435; Granfield, Farrar & Carlin, San Francisco, \$132,253; The Utah Construction Co., San Francisco, \$133,272; Guerin Bros., San Francisco, \$133,341; Heafey-Moore Co.-Fredrickson & Watson Construction Co., Oakland, \$141,533; McNutt Brothers, Eugene, Ore., \$142,968; Hemstreet & Bell, Marysville, \$144,800; United Concrete Pipe Corp., Los Angeles, \$159,500. Contract awarded to Parish Bros., Hollywood, \$121,257.

SOLANO, SAN JOAQUIN, CALAVERAS, AMADOR, STANISLAUS, MARIPOSA AND TUOLUMNE COUNTIES—Furnishing and applying Diesel oil to 280.4 miles of roadside vegetation. District X, Claude C. Wood, Lodi, \$5,236; Oilfields Trucking Co., Bakersfield, \$5,674; Pacific Truck Service, Inc., San Jose, \$6,378; Lee J. Immel, Berkeley, \$5,545; Hayward Material Co., Hayward, \$5,593. Contract awarded to Sheldon Oil Co., Suisun, \$4,496.

SOLANO-YOLO COUNTIES—Between 1.3 miles north of Dixon and one mile east of Davis, about 7.3 miles to be graded and drainage facilities installed. District X, Routes 7 & 6, Sections I, A, E. Parish Bros., Hollywood, \$129,444; Maceo Construction Co., Clearwater, \$138,302; Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, \$138,354; A. Teichert & Son, Inc., Sacramento, \$139,568; M. J. B. Construction Co., Stockton, \$140,159; Guy F. Atkinson Co., San Francisco, \$144,054; Harms Bros. & N. M. Ball Sons, Berkeley, \$145,548; J. R. Reeves, Sacramento, \$145,743; Utah Construction Co., San Francisco, \$151,170; Louis Biasotti & Son, Stockton, \$152,415; Pionbo Bros. & Co., San Francisco, \$153,821; Claude C. Wood & Elmer J. Warner, Lodi, \$154,011; Hemstreet & Bell, Marysville, \$162,022; Frederickson & Westbrook, Sacramento, \$165,620; A. S. Vinnell Co., Alhambra, \$167,082; Eaton & Smith, San Francisco, \$180,317; Claude Fisher Co., Ltd., Los Angeles, \$198,034. Contract awarded to Frederickson Bros., Emeryville, \$127,301.

State of California

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Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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FRANZ R. SACHSE, Assistant Director

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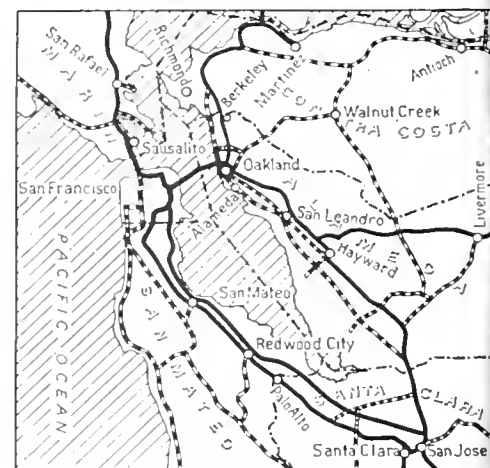
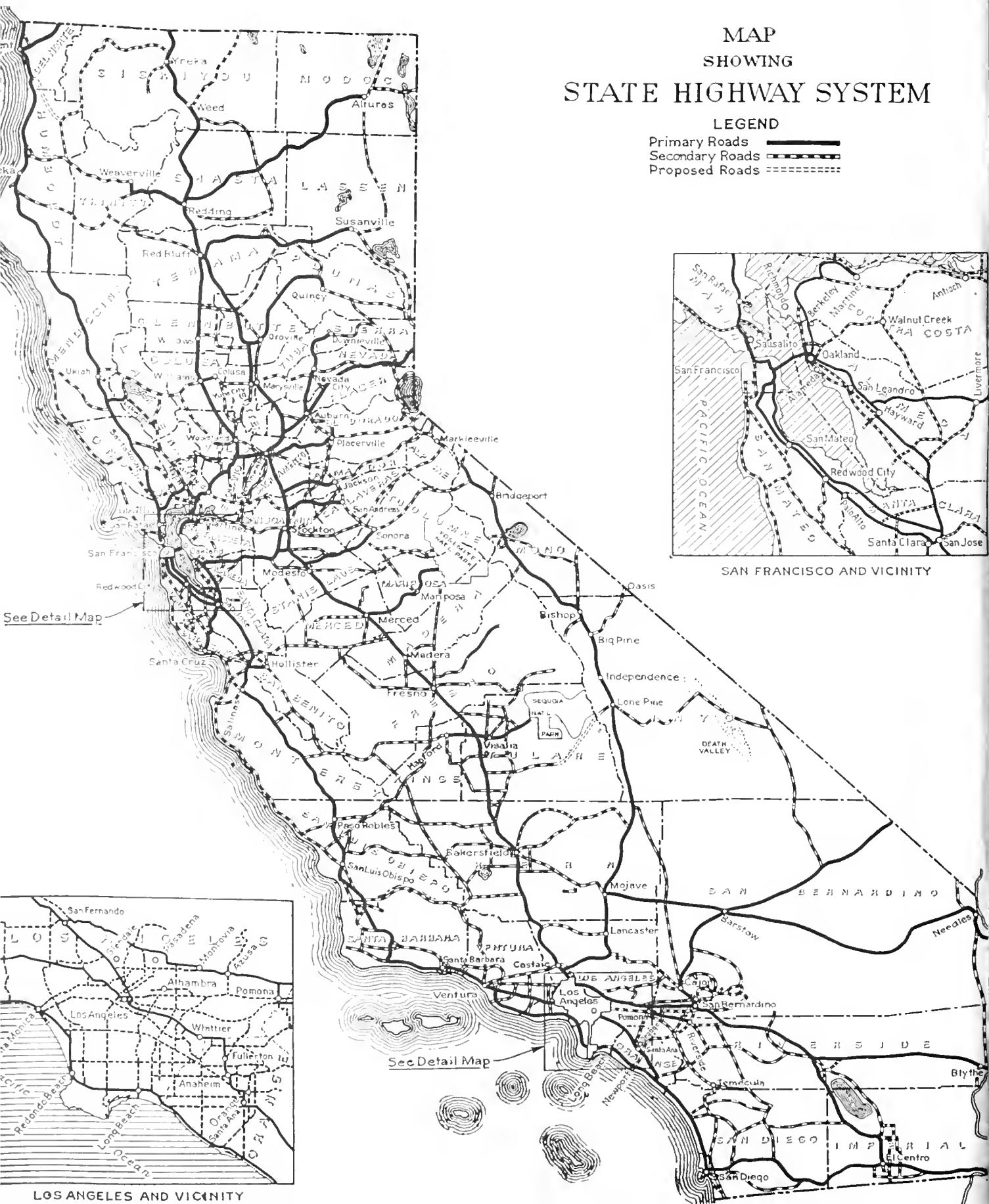
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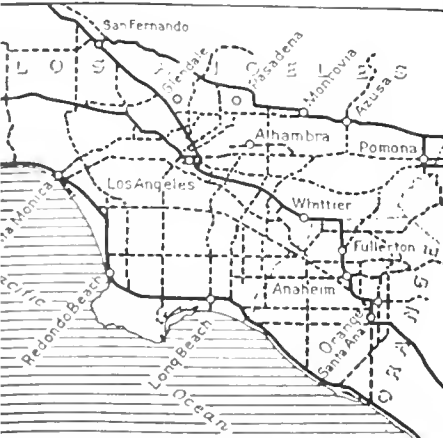
MAP SHOWING STATE HIGHWAY SYSTEM

LEGEND

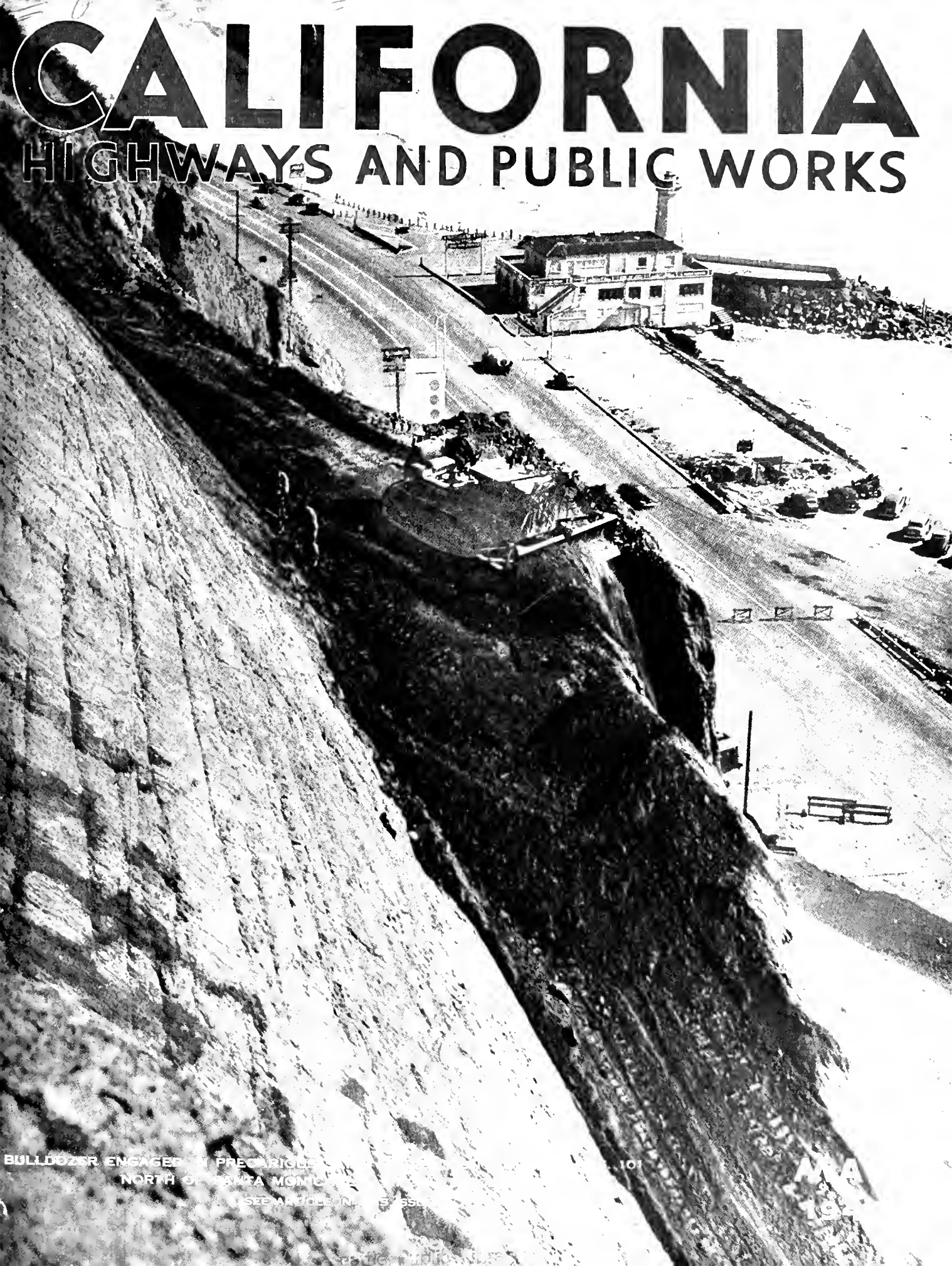
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CALIFORNIA

HIGHWAYS AND PUBLIC WORKS

BULLDOZER ENGAGED IN PRECARIOUS WORK
NORTH OF SANTA MONICA
SEE ARTICLE IN SEPTEMBER 1964

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California

FRANK W. CLARK, Director

C. H. PURCELL, State Highway Engineer

J. W. HOWE, Editor

K. C. ADAMS, Associate Editor

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California Highway Program Requires More Federal Aid For Projects Within Cities

By C. H. PURCELL, State Highway Engineer

During the latter part of last January, State Highway Engineer C. H. Purcell went to Washington upon invitation of the Roads and Highways Committee of the House of Representatives to express his views on the subject of Federal Aid to States for highway construction and to discuss provisions of a bill now pending in Congress to authorize the Reconstruction Finance Corporation to make loans at cost for highway work to States which are in a position to borrow such funds. In the following article Mr. Purcell deals with the highway situation in California in relation to the measure now being considered by Congress.

THERE is pending in Congress a bill, known as the "Highway Right of Way Act of 1940," which proposes legislation of vital importance to California. Briefly, the measure provides that the U. S. Commissioner of Public Roads may acquire in the name of the Federal government real property required by any State in the construction of any road project which will be a post road or will foster interstate commerce, aid in national defense, facilitate the use of the mails or promote the general welfare.

Further, the bill authorizes the Reconstruction Finance Corporation to make loans to States, municipalities or other public bodies at cost to finance or aid in financing the acquisition of rights of way for road projects which will accomplish the purposes above enumerated.

The act provides that the Attorney General of the United States shall institute and carry on all condemnation proceedings for the acquiring of necessary rights of way on highways declared to be Federal routes.

MORE FEDERAL AID NEEDED

Under the provisions of the bill, Reconstruction Finance Corporation loans would be backed by 40-year revenue bonds which would be redeemed by States, municipalities or other bodies from highway toll collections or other available revenues.

The procedure would be similar to that under which the State of California borrowed \$70,000,000 from the Reconstruction Finance Corporation



C. H. PURCELL

to build the San Francisco-Oakland Bay Bridge. Through the sale of Bay Bridge bonds, the government's loan in this instance has been repaid with a profit of \$2,000,000 for the Reconstruction Finance Corporation.

I am particularly desirous that California be permitted to borrow Federal funds at cost or that increased Federal aid be given to our municipalities for highway improvements.

The importance to our State of the

bill now before Congress is that the California Division of Highways now is launched on a program of constructing express highways in congested metropolitan areas where the cost of rights of way are prohibitive from the standpoint of the State's financial ability to pay.

HIGH RIGHT OF WAY COSTS

We feel that there are a great number of cities and metropolitan areas where regional highways are of as much importance to a national system as to the individual States. We are contributing to this national system and we have reached a point where we must have credit assistance. What stops this development is the large cost of right of way.

In the first place, it is difficult to finance a project which represents a large right-of-way cost. The ordinary banking channel is an expensive one to start with and it is often the better project which is turned down. The Federal Government has the organization to investigate these projects through the Public Roads Administration and the authority to do business through the Reconstruction Finance Corporation. We believe that projects can be offered—we know they can in California—that will return the investment if we can obtain assistance in the right-of-way acquisition.

Property bond issues for such ventures have not been a success, and we can not resort to this means of financing. It is too often true that the

(Continued on page 26)



Funston Avenue Approach, tunnel in distance, before being opened to traffic.

Funston Avenue To Golden Gate

By LARRY B.
California Highway

ON MAY 28, 1937, the world's longest bridge span across our Golden Gate was opened to traffic and the watery bonds which had hampered the free flow of communication between San Francisco and the California north coast country were forever broken.



L. BARRETT

With the dedicating on April 21 of the Funston Avenue Approach to the Golden Gate Bridge, a new and modern freeway through the historic Presidio of San Francisco, we have provided additional facilities for still more unrestricted traffic flow between San Francisco and the Redwood Empire to the north.

This new highway presents direct connection between the Golden Gate Bridge and many of the principal residential sections of San Francisco. It provides the shortest connection with through city arterials to two of the three main highways down the peninsula.

Aside from its purpose as a public traffic utility, the building of this approach to the highway across the Gate represents the success of the American democratic form of government, which is based upon theories of co-operation and compromise. The building of the short two miles of this new freeway is an example of the practical application of these democratic theories.

Six separate public agencies of the American people were involved in construction of the project:

The United States Army, over whose lands the greater portion of the highway was placed;

The City and County of San Francisco, whose citizens were most vitally interested in the added facil-

Colorful Dedication Scenes

WITH brilliance and color, international in flavor, the new Funston and Nineteenth Avenue Approaches to the Golden Gate Bridge were formally dedicated and officially opened to traffic Sunday, April 21. Thousands of people participated in the day's events, many of them arriving in spectacular Cavalcade formations from various parts of the Pacific Coast, the largest being from the Redwood Empire, Mission Trails and Southern California.

Dominant in the presentations, each of which was brief, were expressions of friendly good-will and the importance of construction of more highways, for the promotion of perpetual peace and for mutual benefit.

The dedication ceremonials were staged by the Mayor's Citizens Committee of San Francisco, headed by Supervisor John M. Ratto, chairman.

Operating plan and script were designed and executed by the Redwood Empire Association, the General Manager and staff of which served in technical and productive capacity, San Francisco being a part of and

Southern Gateway to the Redwood Empire.

Importance of the Funston and Nineteenth sectors, in the Pacific Coast International and National Highway Systems was emphasized by the speakers, who complimented those who financed the several units respectively, namely: California Highway Commission and State Department of Public Works; U. S. Public Works Administration; City and County of San Francisco; Works Progress Administration (section through Golden Gate Park); the engineers, contractors and those labor groups actually performing the work.

Motif for the Funston Avenue Dedication Ceremonial, formal in nature, was the promulgation of friendly relations between Canada, Mexico and the United States, and exchange of visitors between these nations and the Pacific Coast States.

"Wedding of Pacific Coast travel interest" was the theme for the Nineteenth Avenue dedication.

Speakers for the Funston Avenue Dedication included: Supervisor

(Continued on page 21)

ie Approach te Span Open

ETT, Chairman,
Commission

ity and who allocated a large portion of the city's share of 1-cent gas tax funds for the work;

The Golden Gate Bridge and Highway District, whose directors saw in the new approach a greater bridge service;

The Public Works Administration, which provided funds for nearly one-half the cost of the work;

The California Highway Commission by whose authority State highway funds were allotted to provide the remaining necessary funds;

The California Division of Highways whose Engineers designed and supervised construction of the project.

Two years of negotiation by the city, the bridge district, the War Department and the State were required before an agreement was reached that the road should be built by the Division of Highways. During these negotiations many difficulties were met and overcome through cooperation and compromise by the several agencies involved, and on July 27, 1938, the United States War Department issued a permit to the State for construction of the new route across the Presidio.

The plans finally adopted met the requirements of the Army in crossing the Presidio Grounds; the city of San Francisco in connecting with arterial street improvements between Golden Gate Park and the Presidio; the Golden Gate Bridge and Highway District in satisfactory connections with its approach viaduct, and the State in the matter of construction standards of the State Highway System.

As I said, the Army permit was issued on July 27, 1938. Seventeen days later, on August 13, the State

(Continued on page 14)



Top—Dedication dignitaries. Left to right—Amerigo Bozzani, Highway Commissioner; Hector M. Escalona, Consul General of Mexico; Director of Public Works Frank W. Clark, J. Gordon Smith, representing British Columbia; Larry Barrett, chairman, and L. G. Hitchcock of Highway Commission. Bottom—New Funston Avenue Approach looking toward Golden Gate Bridge, tower of which is seen in left background.

California Snow Survey Assures An Ample Water Supply This Year

By FRED H. PAGET, Associate Hydraulic Engineer

SUPERVISED and coordinated by the State Department of Public Works, the annual survey of California's snowpack has just been completed throughout the Sierra Nevada.

Employees of the State Division of Water Resources made the snow surveys in the Rubicon Watershed, tributary to the American River, also on Mount Shasta, and in the Alpine Lake region of the Stanislaus River watershed. In all other areas the surveys were made by cooperating organizations interested in knowing the amount of water in the mountain snowpack.

Rangers of the eleven National Forests and the four National Parks covering the Sierra, made measurements in their districts. The power companies, the irrigation districts, and the municipalities sent their own men to the watersheds supplying the water for their activities. The Division of Irrigation of the Soil Conservation Service helped pay some of the expenses.

SKI PATROLS

From the Klamath to the Kern, ski patrols of two or three men—never one man alone—penetrated deep into the snow country to visit each of the 230 established snow measuring stations. Starting from some 70 strategically chosen starting places scattered along the snowline, about 150 men in all took part in this year's survey.

Some of the trips were completed and measurements made in one day, but most of the men were out longer. In the vast winter-locked watersheds of the Kings and Kern Rivers, the ski patrols were out 18 and 14 days, respectively. Overnight they sought shelter in the cabins provided along their routes, stocked before the onset of winter with food, fuel and bedding. Carrying on their backs the hollow aluminum measuring tubes, they visited each measuring station in turn and there made measurements strictly

in accordance with instructions printed on the map of the snow course.

ENCOUNTER STORMS

Those parties forced to start early to complete their schedule on time, were caught in the mountains by the big storm at the end of March. Those that were at high elevations holed up in the shelter cabins for several days and waited for the blizzards to subside before venturing to complete their trips. Lower down, where it was not so cold and it was snowing and raining together, some of the parties took shelter on the worst day, but some worked right through, storm or no storm.

Descriptive of some of the trips are the following accounts taken from the routine reports turned in by the snow surveyors:

"We started in the rain on the 28th—on the 29th we skied into Chiquito Meadow and measured that course in the rain. It turned to snow soon. We went to Jackass Meadow and stayed there overnight. The snow was very wet and dragged on the skis all the way. The 30th we measured Jackass Meadow course, then went into Clover Meadow. It turned quite cold, but we wanted to clean up the measuring so we measured the course in the snow before changing our wet clothes. This was the third day we were wet. It snowed all night. On the 31st we realized that it would be well to let the snow settle—but did not want to sit around and delay our return one day. We decided to try it a mile or two and see how it went. We started at dawn. The sun came out. * * * Snow fell from the trees in large patches—down our necks. The going was the toughest yet. We sank ten or twelve inches going up 1500 feet increase in elevation in the seven miles to the course and took seven hours. * * * We returned in three and a half

hours, using the packed down tracks made going up. Got in just at dusk."

"We started out on the 28th and got back on the 1st; had tough going all the time and were wet through most of two days."

"We had very bad breakable crust coming back from Piute—I took a very easy fall and sprained my ankle. I made it down the rest of the way quite slowly, but that night and the next day my ankle was pretty sore and swollen. It is getting along all right, though."

"* * * says the trip was so hard that he does not want to go again at this time of the year. They had to walk down hill in soft rotten snow, and could not slide any day."

"All in all we had a very nice trip, although we had to lay over five days due to storms and even then traveled two days during storms. * * * We had another "bear episode" in the cabin at Glenn Flat. He practically cleaned out all the grub. He must have been at the height of a pre-hibernation hunger fit, as he even ate the soap and candles. We were lucky enough to be carrying a little with us, so didn't suffer any for lack of food, regardless of Mr. Bear."

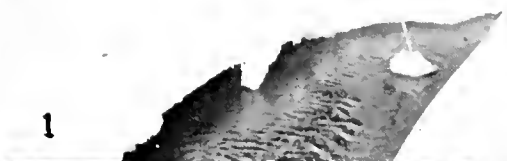
REPORTS FILED

Upon the return of each ski patrol to its base, the notes of the snow surveys were transmitted to Sacramento by letter mail, air mail, telephone, telegraph and radio. At the office of the Division of Water Resources the figures were checked, tabulated and analyzed and each fragment of information fitted into its place in one vast mosaic to form a true picture of the whole.

This year, due to the many warm storms that reached California from the Pacific tropics, rain repeatedly fell



2



1



3



4

A thirsty snow surveyor gets himself a drink. Using his ski pole (Photo No. 1), he dunks a ball of snow into the open stream channel, draining a satisfying draught from the saturated, sponge-like ball of snow (Photo No. 4). The joys and sorrows of snow surveying. Making a measurement while the wind howls and a blizzard rages (Photo No. 2). The same snow weighing operation with California Sunshine starting the snow surveyor on his way to acquire a healthy coat of tan (Photo No. 3).

at altitudes where under normal conditions most of the winter's precipitation occurs as snow. Due to this, the snow line at the first of April was unusually high, there being practically no snow below elevation 6000 feet. Above this, the snow cover gradually increased with elevation until at the 7500 foot contour it was practically normal. Above elevation 7500 feet,

the snowpack was almost everywhere above normal.

On the whole, considering the opposing effects of the lack of low snow coupled with excess quantities up on top, and taking the Sierra north and south, there is this year about three-quarters of a normal snowpack. This is a much better snow crop than last year's, but not so heavy as that of

two years ago. It insures ample water for all of California's needs during the coming summer and carries little threat of floods even at the peak of the snow melting period. Because of the quantities of snow at high elevations the late summer flows of most streams should be good.

The menace of salinity in the rich

(Continued on page 21)

Pomona Grade Separations Will Provide New Highway Connection

WITH the opening to traffic of the West Pomona grade separation project, an important highway connection for the adjacent through highways was placed in service and another congested and hazardous grade crossing situation was materially relieved. This newly opened section of highway is a portion of the proposed relocation of State Highway Route 77, which is the route connecting with U. S. 60 at Pomona and running south through Corona to connect with U. S. 395 at Elsinore.

This project included the construction of the one-half mile highway connection between Holt Avenue, U. S. 60 and Fifth Avenue, which carries the State highway

traffic, a real saving to the traveling public will result, both in time, human life and property.

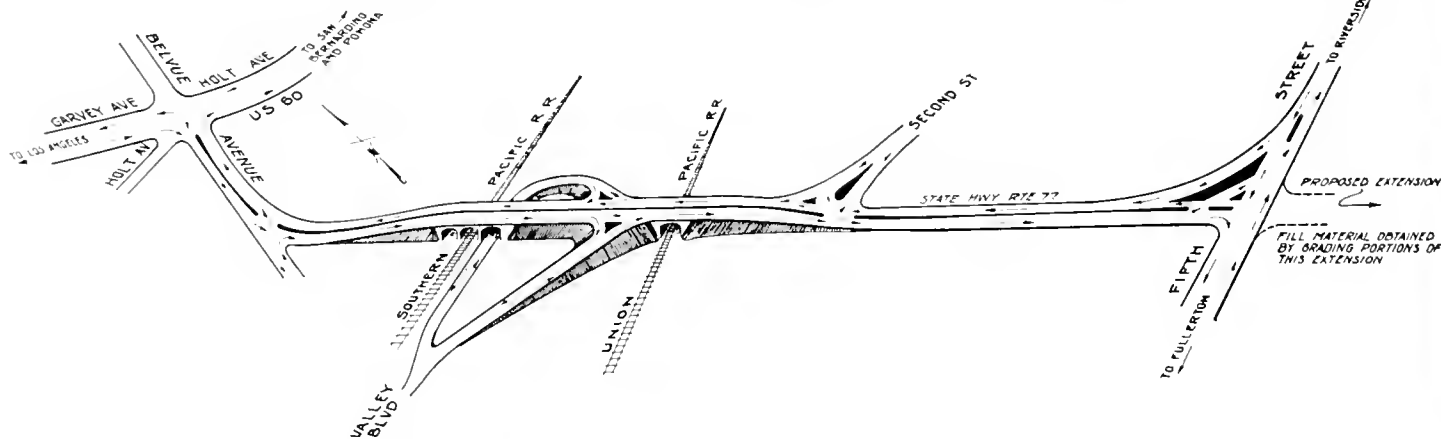
The Southern Pacific Railroad overhead was an entirely new continuous reinforced concrete girder structure 235 feet long. The seven-girder bridge crosses the railroad at a high skew with a span of 48 feet. Another span of 53 feet has been provided to accommodate future additional tracks. One of the ramps to Valley Boulevard curves down and crosses back under this structure. The minimum roadway maintained through the length of the project consists of two 25-foot traffic lanes separated by a 4-foot concrete-curbed dividing strip.

The widening of the Union Pacific

than 22 feet, extensive fills were necessary to carry the main roadway and approach ramps up to this elevation. The material for these fills was obtained by doing the grading on two sections of the proposed extension of the project to the south. The material was taken out of two small cuts through low hills at a distance of about three and one-half miles from the structures.

The completion of this work incidental to obtaining the fill material will result in cheaper construction cost when the remainder of the relocation is completed.

The main highway connections to the overheads were graded to a minimum width of 64 feet to provide two 25-foot traffic lanes, a cen-



This sketch map shows locations of new Pomona grade separations which will eliminate traffic congestions.

route running through Fullerton to Pomona; an overhead structure over the Southern Pacific Railroad tracks; widening the existing overhead over the Union Pacific Railroad tracks; and the connecting approach roads. The construction of the railroad structures and a portion of the highway connection was included in the Federal Grade Separation Program. This separation project will enable through traffic on U. S. 60 and southbound traffic to by-pass a very congested grade crossing in the heart of Pomona.

Inasmuch as a considerable portion of the traffic is now able to by-pass the congested crossing in town as well as to avoid the heavy city

Railroad overhead was accomplished by placing three continuous reinforced concrete girders on each side supported on separate extensions of the existing piers. The length of the structure was also increased from 115 to 135 feet by the addition of a short cantilever span on each end. The widening provided approximately 20 feet on each side of the roadway, giving two 35-foot lanes on each side of the dividing strip. This allows for an extra accelerating lane on each side to accommodate vehicles coming onto the main highway from the side approaches.

Because it was necessary for the roadway to rise above the flat valley to clear the railroad tracks by more

ter dividing strip, and a seven-foot shoulder and berm on each side.

Between the two structures, an eleven-foot accelerating lane with concrete curb and gutter were used in place of the seven-foot shoulders, to permit vehicles coming onto the main highway from the side approaches to gain sufficient speed to get into the main traffic stream without the hazards which accompany breaking into a fast moving traffic line while traveling at a slow speed. All the side approach roads are two lanes with a 26-foot width between curbs.

The contract for the work on both the overheads and their highway connections was awarded to John



Pomona grade separations. Southern Pacific underpass on left. Top of Union Pacific underpass can be seen in right background.

Strona of Pomona on March 14, 1939. The structures were opened to traffic on March 19, 1940. The total cost of the entire project, the separation structures combined with the roadway and approach fill

work, was \$196,000, of which about \$175,000 was furnished from a Federal Grade Separation Allotment.

The cost of the new Southern Pacific Railroad overhead was about \$56,000 while the cost of widening

the existing Union Pacific Railroad overhead structure was about \$18,000. P. R. Watson was Resident Engineer, assisted by engineers assigned to the project by District VII to supervise the highway work.



South channelization of approach to Pomona grade separations. Highway Route 19, Pomona to Fullerton, in foreground.



View of Kern County's equipment and crews on section of Ducor Cut-off in Kern.

Counties Cooperate on Highway

THE improvement of the Orange Belt Scenic Highway extending along the easterly side of the San Joaquin Valley from General Grant Park southerly to Bakersfield has been of great interest to the people of Tulare and Kern counties for many years.

To attain a better transportation route over an entirely new alignment, which would eliminate several grade crossings and at the same time shorten the distance between Ducor and Bakersfield by approximately five miles, has been the dream of citrus fruit growers and motorists for a long time. So anxious were residents in the communities along the Orange Belt Scenic Highway to have this improvement started and carried on to an early completion that the two counties through which the proposed improvement would pass offered their assistance in constructing portions of this State highway.

In Supervisor Jay Brown's district, in Tulare County, it was agreed to furnish equipment and

labor to grade a stretch of highway 1.2 miles in length, involving some 115,000 cubic yards of excavation. This section of the highway, while comparatively short, involved the heaviest excavation per mile on the entire 32 miles included on what is known as the Ducor Cut-off, extending from Ducor to the vicinity of Bakersfield. Tulare County has recently completed the work undertaken by it and an excellent job has resulted.

In Kern County, Supervisor W. R. Woollomes agreed to grade and install drainage structures, including a bridge, on a 3½ mile section between Poso Creek and the Famoso-Woody Road. The Kern County work is now progressing rapidly and excellent results are being obtained. In both Kern and Tulare counties the work is being done in accordance with State plans and specifications, and on both jobs the State has provided an inspector.

The work by both counties has been carried on most harmoniously, the counties cooperating with the

State to the fullest extent. Such fine cooperation can only result in advancing by many months the completion date of this portion of the Orange Belt Scenic Highway.

Both counties have elected to use on the jobs undertaken by them the most modern road building equipment. Tulare County put to work six large tractors, with four carry-alls ranging in size from 6 cubic yards to 13 cubic yards capacity, together with tow graders, rooters and other equipment. Kern County purchased a new ¾-cubic yard shovel for its job and furnished five dump trucks, two 4-cubic yard wheeled scrapers, together with pull graders, motor patrols and other units. The use by the county supervisors of the best equipment available has not only resulted in a good job on the State highway but is reflected in the fine county road work to be found in their respective districts.

The sections on which work is being done by the counties are on a location made by the State. Plans and specifications were prepared by the



Division of Highways. The plans provide for a 36-foot graded roadway with oil treated surfacing 22 feet wide. The highway has been designed for minimum sight distances of 2300 feet, which will permit fast traffic to drive safely. A bridge 40 feet in length and with 26-foot roadway designed by the Bridge Department will be built by Kern County at Little Creek.

Supervisors Brown, Allumbaugh and Woollomes have given the work their personal attention.



Top—Crew finishing cut slope on Kern County's section of cut-off. Center—Graded roadway nearly completed. Bottom—Shovel purchased by Kern County for project.

New Sidehill Viaduct Will Break Bottleneck On Santa Cruz Highway

By I. T. JOHNSON, Resident Engineer

WORK recently was started on the construction of a sidehill viaduct just south of Los Gatos on the Santa Cruz Highway as Unit No. 2 of a project designed to break the short bottleneck created by the recent completion of the four-lane highway from that point south, crossing the Coast Range Mountains.

The viaduct is situated near the center of a section of narrow, twisting roadway approximately two miles in length lying on the west canyon slope of Los Gatos Creek, just south of Los Gatos. Below the highway location is situated the main line rail-

road track serving Santa Cruz. The narrow canyon and the presence of the railroad, creek, water flume, power and phone lines, as well as the highway and a high-pressure water line have made location and construction of this section unusually difficult.

TOURIST ROUTE

This route serves the beach and resort areas of the Santa Cruz vicinity and is used by a large number of tourists and vacationists. Traffic has been increasingly heavy on this highway and increased highway

widths and improvements apparently serve to stimulate further traffic flow from the bay area.

The difficulty of achieving a satisfactory and economical location for a four-lane roadway, as well as of obtaining sufficient funds for construction, necessitated delay in completion of the adopted design. The canyon slopes for some distance were too steep to permit embankment widening, while the other areas required both extensive channel revision and waste of excavation to obtain the desired location.

Studies were undertaken last sum-



Driving steel "H" piles with crane driver and forming pile bent caps before pouring reinforced concrete caps on sidehill viaduct project south of Los Gatos.

mer to determine the best way of obtaining satisfactory roadway width through approximately 1000 feet of steep, narrow canyon where the railroad track paralleled the only possible location. Various types of retaining walls and cribbing were investigated, but were rejected owing to the relatively high costs and because of foundation problems. Studies indicated that a sidehill viaduct structure designed to utilize the old road width and provide additional width as required for the full section would be the most satisfactory solution.

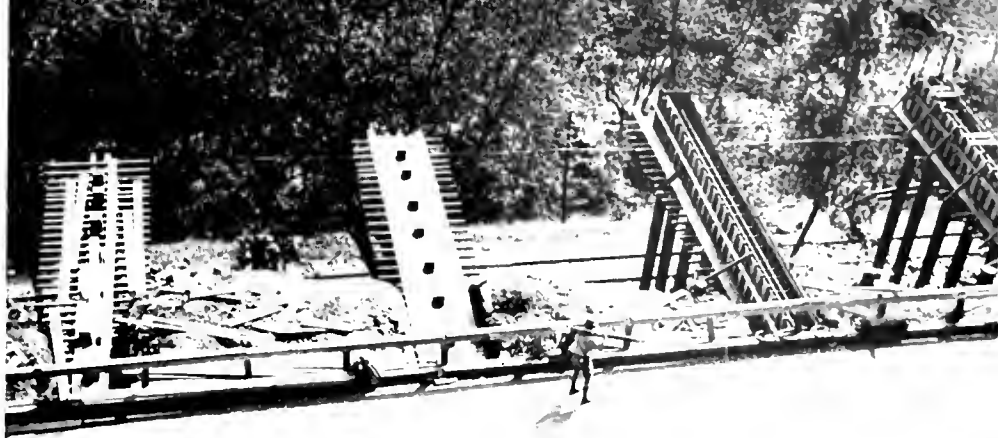
CONCRETE DECK ROADWAY

The structure adopted consists of a reinforced concrete deck roadway carried on lines of rolled steel beams on concrete caps. Bents are located at 25-foot intervals radially and consist of steel "H" piles driven to 32 tons bearing. The number of piles used in each bent varies with the width of structure desired at that location. Four different widths were used throughout the length of bridge. A narrow sidewalk on the east or creek side complete the structure.

Preparatory to construction and final design, an investigation crew drilled sample holes for determining the nature of the subsurface material and probable length of piling required. This investigation showed the bank to be talus to considerable depths deposited from the adjacent mountain slopes. The formation in this vicinity has been badly shattered by earth movements and can not be clearly classified. The San Andreas fault is located approximately ten miles south of the project. All investigations emphasized the necessity of avoiding heavy cutting at the viaduct location to reduce slide menace and further unbalance the excavation items.

PILE DRIVING OPERATIONS

Several methods of handling pile driving operations were considered for this project owing to the extremely limited room available for construction purposes. On the one hand it was necessary to provide an ample roadway for traffic; while on the other hand no falsework was permitted on the canyon slope below the roadway to reduce slide dangers to railroad operations. The contractor finally decided to use a crane driver operating from a narrow bench just



Forming of concrete caps on steel "H" piles. Center view shows difficulty of widening in narrow canyon due to proximity of railroad track.



Views showing viaduct pile driving operations. Completed roadway will be 50 feet wide.

below the traveled roadway having the outside track carried on blocking with a minimum of falsework. The only other solution would have required a skid driver 90 feet long with resulting difficulties in operation, owing to the varying gradient and superelevations. The alignment for the viaduct comprises three horizontal curves and three vertical curves with connecting transitions.

Driving the steel piles proved to be a considerable problem. Penetrations varied as much as 25 feet in two adjacent piles in a single bent. A special "wrench" was used to hold the piles from twisting in the rocky formation, built of 6-inch "I" section and powered from a crane drum. Considerable tendency to drift from position was observed while driving a given pile and was overcome by either blocking the pile or removing the obstruction, if accessible. The piles required varied from a minimum of 8 to 10 feet in length to a maximum of 62 feet.

Project Unit No. 1 consisting of grading and surfacing, contains the following approximate amounts of work:

- 335,000 cubic yards excavation.
- 1,700,000 station yards overhaul.
- 10,000 tons crusher run base.
- 6,500 tons plant mixed surfacing.
- 900 cubic yards concrete and masonry construction.

Project Unit No. 2, the sidehill viaduct, contains the following approximate amounts:

- 420,000 lbs. steel piling and beams.
- 310,000 lbs. reinforcing steel.
- 1,700 cubic yards reinforced concrete.
- 25,000 lbs. miscellaneous steel.

FOUNDATION PROBLEMS

For this structure, the principal construction problem is naturally one of foundations. The steel and concrete superstructure construction offer but slightly more than usual difficulty, although embodying several new and unique details for adjusting the steel beams for length and grade. The concrete is handled from mixing trucks into place by bottom-dump bucket swing from a 1-yard shovel crane. The structural steel is to be erected from the temporary roadway

(Continued on page 21)

Prevention of Slides as A Safety Factor

By DOUGLAS H. GREELEY
Assistant District Maintenance
Engineer

ONE of the most popular highways in the State, carrying as many as thirty thousand vehicles a day follows the coast westerly from the city of Santa Monica. For a distance of several miles, high palisades flank the highway on the land side, extending over two hundred feet high much of the way. This formation, almost vertical in many locations, is a constant problem to highway maintenance. Sedimentary in character and composed of shale, clay and silt, the unstable portions repeatedly cause slides that are dangerous to traffic and costly to remove. The present pavement of the Roosevelt Highway consists of forty feet of asphaltic concrete, the inner shoulder being fourteen feet in width while the one on the ocean side often extends as far as fifty feet.

Storms are usually more severe in the Santa Monica area than elsewhere in the Los Angeles basin and this fact, together with the topography and sparse vegetation, greatly increases the difficulty.

Since the storms of 1938, very severe ones occurring in March and again in December, it has been found advisable in several instances to terrace a high cliff from which a slide appears probable, thereby often moving less material and eliminating the hazard to traffic. This can be accomplished during good weather at a cost considerably less than possible in stormy weather. The method also eliminates the probability of a closed highway, this being an important consideration on a road as heavily traveled as the Roosevelt Highway.

The accompanying pictures show a cliff two hundred feet in height situated one-half mile west of Santa Monica Canyon. Water seepage, probably from lawn and flower garden irrigation above, caused several portions to fall. Due to this hazard it was decided that approximately



This photograph shows a completed section of slide prevention work near Santa Monica where retaining wall prevents slides from blocking State Highway seen at base of unstable cliff. Highway traffic was endangered by these Palisades.



Clearing summit of Santa Monica Palisades of dangerous slide material

five thousand cubic yards of material should be removed by terracing, all work to be done by a ninety horsepower tractor and bulldozer. After placing a high dike along the centerline of the pavement to prevent material striking any vehicle, a slope was carried down to a single terrace approximately eighty feet above the pavement. To do this necessitated a close approach to a street above, and the bin-type metal cribbing subsequently placed is clearly shown in the picture. This work was rather spectacular since the bulldozer was capable of pushing a large amount of material over and the public displayed considerable interest in watching it.

It is believed that this work, preventative in character, has cost less than a large slide removal, and the traveling public is no longer subjected to the hazard the unstable cliff caused.

Cost to the Maintenance Department for the clearing of slides of the magnitude possible at this particular point more than justifies the expenditure of funds here for slide prevention.

Golden Gate Span Approach is Dedicated

(Continued from page 3)

submitted the project to the federal Public Works Administration and within six days received the acceptance of the project for construction as a PWA docket. A call for bids on the first contract was immediately published by the Division of Highways and within six weeks from acceptance by the PWA, on October 3, 1938, construction operations on the grading contract were begun.

The project as planned and built extends from the intersection of Lake Street and Park-Presidio Boulevard on the south side of the Presidio to a braided connection with the main approach viaduct of the bridge, a net length of approximately $1\frac{1}{2}$ miles. The total length of construction, including the four on and off ramps at the bridge approach, is slightly over two miles.

In consideration of the right of way given by the Army it was necessary that drainage from the roadway should not empty onto Presidio property; that the highway be tunneled under the golf course, and that Pre-

sidio roads be carried under the freeway.

These requirements necessitated construction of two master drainage systems, one emptying into Mountain Lake at the south end of the project and the other into the bay at the north end.

The most spectacular construction feature of the project was the tunnel. This structure was built by the cut and cover method, the reinforced concrete tunnel being built in open cut and the ground returned to its original contours by placing a fill over it. The tunnel is 1300 feet in length, built for four lanes of traffic and is provided with a ventilating shaft 24 feet square.

Through the Presidio grounds three reinforced concrete viaducts were constructed as units of the highway. These viaducts carry the freeway over ravines and across Presidio Roads. Viaduct "A," south of the tunnel, crosses West Point Avenue; Viaduct "B," some 500 feet north of the tunnel, is the longest of the

three and crosses Kobbe Avenue. This structure provides a striking entrance for Fort Winfield Scott. Viaduct "C" is about 250 feet north of "B" and crosses Storey Street.

The four ramps, which make the connections to the main bridge approach, provide for traffic distribution by means of modern braided design. This braided design is such that no cars, whether leaving or going onto the main approach, can cross the line of opposing traffic.

Throughout its length this new highway provides the best in modern arterial construction, namely, two wide lanes for traffic in each direction, separated by a central dividing strip. In conformance with present arterial safety standards of the Division of Highways, these lanes are eleven and twelve feet in width.

As chairman of the California Highway Commission, which allocates all State highway funds, I have been most interested in the financing of this million dollar project.

While the final total cost of the six

contracts under which the new freeway has been built have not as yet been computed, it is estimated that the entire work will cost approximately \$1,169,000. PWA Federal funds and State highway money were used in financing all six contracts and on three of them the city of San Francisco contributed from its share of 1-cent gas tax funds.

Costs of each of the contracts are as follows:

Grading, tunnel and drainage	\$580,000
Viaducts A, B, & C	225,000
Viaduct F (Approach Ramp)	55,000
Underpass D, viaduct connection E, and 2 pedestrian undercrossings	97,000
Paving and lighting	172,000
Landscaping	40,000
	<hr/> \$1,169,000

Construction features on the project were numerous. A rough idea of the size of the undertaking may be obtained by looking at a few of the quantities of materials involved.

The entire project involved 508,000 cubic yards of roadway excavation and tunnel backfill and 60,000 cubic yards of structure excavation; 40,000 cubic yards of concrete went into the tunnel, viaducts, structures and pavement; 2500 tons of reinforcing steel was used in the concrete construction; drainage pipes totaled 21,000 lineal feet; and the base for road work required 10,000 tons of rock.

Much credit is due to all who had a hand in planning and constructing the project and on behalf of the California Highway Commission and the Division of Highways may I thank particularly members of the San Francisco Board of Supervisors and the city's engineering staff; Colonel Caples and Major General Simmonds of the United States Army, the directors and engineering staff of the Golden Gate Bridge District and Mr. K. A. Godwin and his associates of the Public Works Administration.

The contractors whose organizations performed the actual construction should also be included among those who contributed to the cooperative efforts in the completion of this highway. Grading, construction of the tunnel and drainage structures were operations performed under contract by the Maceo Construction Company. Contracts for construction of four viaducts were awarded by Director of Public Works Frank W. Clark to the Union Paving Company. The underpass and viaduct connections



Upper—Traffic starts over Funston Avenue Approach. Lower—View of tunnel under golf course in U. S. Presidio.

were built under a contract awarded to M. J. Lynch. The paving and lighting contract also was awarded by the Director to the Union Paving Company and landscaping is being done under contract with the Leonard Coates Nurseries.

IMPROVED HIGHWAYS IN U. S.

There is a total of 11,070 miles of improved highways exceeding two lane widths in the United States, according to figures compiled by the American Association of State Highway Officials. Only two states, Montana and Wyoming, have no roads exceeding two lane widths. New York

leads in three lane widths with 926 miles. Pennsylvania is second with 905 miles. Illinois has 548 miles of four lane highways, and Michigan is second with 394.

California has 74 miles of five lane roads and 49 miles of six lane. Michigan leads the six lane classification with 101 miles, and the eight lane with 22 miles.

“What’s your room mate like?”
“Nearly everything I own.”

Visitor (at dam site): And did they put the dam down to the bottom of the river?
Engineer: No, madam, they left two inches open so the fish could swim through.

California Highways Are Being Built for Mobility and Safety

By J. W. VICKREY, Safety Engineer

EUROPEAN news commentators have been warning us of late that casualties on the war front are far greatly exceeded by traffic fatalities on the highways of the United States. This is shocking news to Americans, who believe that the country is safety minded—who are convinced that the nation is established for the privileges of life, liberty, and the pursuit of happiness.

That life in the most progressive country in the world must meet dangers and hazards in excess of those that exist upon the war fields of Europe is a condition hard to conceive and hard to believe.

Progress in invention and science has given us the automobile and its necessary copartner motor highways; but the same progress has developed a complex problem which demands all the resources of science and human ingenuity in its solution.

HEAVY DEATH TOLL

When thinking people began to realize that annually upon the highways of the United States over 30,000 people were killed and in excess of 100,000 were permanently crippled, a determination arose that something should and must be done.

This realization that a problem existed did not admit that prior to the realization of the problem road engineers and enforcement officers had not been endeavoring to give safe movement to the motorists upon the public roads, but rather that additional study and a more careful analysis of the problem at hand must be made.

"Let's get the facts," said the engineer. "We have reports of all accidents," said the enforcement officer. "We will study them," said both together; "undoubtedly they contain valuable information."

And so accident reports have received careful scrutiny and from their study has been brought to



National Safety Council

light the fact that more than three-quarters of all the accidents on rural State highways are chargeable to the driver, to the human element involved.

Causes of accidents that might be attributed to the condition of the automobile, or the machine, amount to approximately 10 per cent, and causes that might be charged to the roadway, to another 10 per cent. It **must be remembered**, however, that while mechanical failure of the machine may be the cause, the condition of that machine is definitely in control of the owner.

Again, it must be recognized that while causes chargeable to the condition of the roadway may exist, in many cases if the motorist upon that roadway conducted himself with care and caution the accident would not have occurred.

It is quite evident that the driver must receive the greatest amount of attention in the solution of the problem of traffic safety, and rightly he

should. On the other hand, however, there should be no lessening of responsibility that rests upon the shoulders of the automotive engineer or the highway engineer. In fact, there is every reason why these two important figures in the traffic world should work in closer harmony. The automotive engineer has developed and pushed progress in automotive manufacturing far in excess of that which is available to the road builder. The condition is brought about by simple economies—the moneys available.

There are 100,000 miles of public roadways in California. To improve all these roads in the same ratio as has been the improvement of the automobile, is an impossibility. Funds are not available. The road engineer appreciates this fact far better than does the average citizen, for the engineer constantly has before him the problem of expending the funds available for the best interests.

MOBILITY AND SAFETY

The Division of Highways of the California Department of Public Works has mobility and safety as forefront prerequisites in the construction of State highways. Thousands of miles of highways have been constructed and reconstructed to give safe and expeditious transportation for passengers and commodities.

In 1912 narrow, shallow roadways were built to meet the conditions of that time. The 30-mile-per-hour top speed light motor equipment upon the roadway was well provided with adequate road surfaces under the construction program of that day. But automotive travel increased and speeded up as the years passed by—mobility and safety were being challenged.

The Division of Highways studied this problem and two years ago announced a basic change in the stand-

ard highway design. A minimum width of traffic lane in the future would be 11 feet, for two-lane road 22 feet. Traffic requirements on the majority of roads are not expected to demand an increase in the number of lanes over the two-lane pavement.

MULTIPLE-LANE HIGHWAYS

The multiple-lane highway will continue to be the exception rather than the rule. In locations of high congestion, where multiple-lane highways of four or more lanes are needed, separating curbs or even divided highways are being constructed. In order that traffic on the inner lane of the separated roadway may have freedom of movement, these lanes are being constructed to a width of 12 feet.

In conformance with the 11-foot basic lane width now being used by the Division of Highways, bridges and grade separations must be reconstructed proportionately wider. Structures on two-lane highways now have a clearance between curbs of 26 feet, while structures on divided roadways will have a clearance of 27 feet between curbs for each directional roadway. Adoption of this increased basic roadway width and the divided highway for multiple-lane roads will necessarily raise the cost per unit length of highway construction, thus curtailing to some extent at least further possible construction mileage.

The California Division of Highways has decided that, although the wider traffic lane alone can not solve the accident problem, it is still a contribution to highway safety which must be made and is a part of a policy which will be economically solved from the savings of obsolescence alone.

But there are additional safety elements which are constructed in the highways of California other than the reconstruction of roadways—simple elements, which, however, bear greatly upon the safety question. For instance, there is the white traffic stripe—simple but effective.

The annual cost of the installation of traffic stripes, single, double, and two-color type, is approximately one-quarter of a million dollars. This safety feature, however, rests entirely upon the use which is made of it by the human element upon the roadway—a definite responsibility upon the motorist.

Drivers NOT Autos Causing Fatalities

Automotive engineers have made today's motor car the **SAFEST** vehicle in the history of the industry.

It is almost entirely free of mechanical imperfections, has marvelous braking power, is built of the toughest metals and is equipped with safety devices that take the operation of the automobile itself almost completely out of the field of hazard and chance.

But the one field into which engineers can not reach is the **HUMAN MIND**.

Let one incautious, incompetent or foolhardy driver get behind the wheel of the safest automobile ever built, and he can turn it into an **ENGINE OF DESTRUCTION**.

Let a liquor-sodden driver, or a reckless driver heedless or ignorant of safe-driving rules, or a mentally or physically incompetent **FOOL** operate an automobile, and he will offset all science.

Worse, he will nullify the **SAFE DRIVING** of the hundreds of other people who must use the same streets and highways he uses.

He will force safe, sane and courteous drivers into ditches and against concrete and metal abutments.

Safe driving is not a mechanical problem, but a **HUMAN PROBLEM**.

It is not a question of brakes, or tough metals, or safety glass, or even of laws or penalties.

It is a matter of **BRAINS**.

Not engineering, but **EDUCATION**, can stop highway slaughter.

Not automobiles, but **PEOPLE**—reckless, stupid and **DRUNKEN** people—are responsible for the stark annual **HARVEST OF DEATH** on the highways.

Drive safely, and live and **LET LIVE**.

—Los Angeles Examiner.

HIGHWAY SIGNING

Another traffic investment is the \$100,000 spent yearly for the signing of highways, both in the installation of new signs and the maintenance of old signs. The reflectorized sign, now being placed upon our roadways, is definite warning of both day and night conditions which exist. Again, the value of these signs rests entirely upon the use made of them by the motorist.

These two safety features depend entirely upon the willingness to be controlled. But there are still other simple features which more or less control by physical barrier. For instance, thousands of feet of guard rail are placed on the highways of California and hundreds of sight posts. To these can be added now, on multiple-lane roads, the dividing island feature as well as separated highway planting. Another controlling physical barrier is the development of channelization used at intersections of congestion and hazard.

Early in 1938 the Division of Highways created a new unit known as the Department of Traffic and Safety. The department in no way supersedes or conflicts with safety activities already under way but strengthens and augments these activities, combining its efforts with others in an endeavor to analyze and study traffic statistics to advance the movement toward the goal of safe highway driving.

RECURRING ACCIDENTS

All new highway design is studied by the Department of Traffic and Safety to see that no possible safety features are overlooked. The relation of traffic problems to other economic and social problems is also kept in mind. It is well known that there is no all-inclusive method of obtaining traffic safety. The methods are still in the process of development.

During the last two years it has been the Department's opportunity to make careful studies of accident reports available so as to determine sections of high accident frequency. These points of recurring accidents may be located upon old roadways or upon more modern highways. When located, careful study is made of existing conditions and the causes indicated upon the accident reports.

(Continued on page 28)

WHAT IS RIGHT OF WAY WORTH?

LESS than half of what the State of California offered to settle for in the first place, a price of \$420, was ascertained today by a superior court jury to be a fair value of 18.10 acres of land owned by Thornhill Francis Broome near Point Mugu.

The State agreed to pay Broome \$950 for the same parcel before the case went to trial. After 10 days in court, listening to the testimony of expert witnesses for both sides, a jury of 11 persons deliberated four hours and found that \$420 would be a fair value.

The State condemned the property in order to realign portions of Roosevelt Highway.

When Cliff Young, a Ventura member of the jury, became suddenly ill Tuesday, attorneys stipulated that the 11 remaining members of the jury would be permitted to make the decision. Foreman Raymond A. Ellis read the verdict at 8.20 o'clock last night. The trial opened March 19 and was continued from time to time.

Broome, owner of thousands of acres of land south of Oxnard, brought to the stand among other witnesses:

Edward H. Allen, Los Angeles appraiser, whose estimation of value and damages was \$29,725, and Charles B. Frisbie, civil engineer and appraiser of Los Angeles, whose value and damage report was \$32,050.

State Division of Highway witnesses included:

W. P. Thomsen, mining engineer and appraiser of Pasadena, who testified the land was worth \$600; William C. Ramelli, Ventura realtor and appraiser, value \$54, and James S. Fulkerson, Sr., realtor and appraiser of Ventura, value \$59. None of the State's witnesses believed the land had been damaged.

Broome's attorneys were Vincent Morgan of Los Angeles and Charles Blackstock of Oxnard. Clifford D. Good was attorney for the State.—*Ventura County Star-Free Press*, April 4, 1940.

WHAT price real estate? The question has been at issue before a Ventura County jury in a local highway condemnation matter.

Two appraisers, witnesses for the land owner, set valuations on the strip in question at \$29,725 and \$32,050, respectively.

Appraisers who testified as expert witnesses for the Highway Department set valuations, respectively, of \$600, \$54 and \$59.

After hearing testimony and arguments for two weeks, the superior court jury brought in a verdict fixing the amount at \$420.

Recently in Santa Cruz County a jury decided on \$3,000 as the proper price for land needed to extend a street; there the property owner had asked \$40,000. Following the announcement of the verdict, Judge James L. Atteridge turned to the jurors, and remarked:

"I am about to discharge you from duty on this trial and I want to commend you for your verdict. Recently there has grown up here a racket in these condemnation cases, and in this case there was offered some of the wildest and most chimerical testimony as to the value of property that I have ever heard. Now, as a frequent trier of matters of fact, I regard some of that testimony as an insult to the intelligence of a person."

Similar expressions are being heard in Los Angeles County, where condemnation proceedings have been frequent. In fact, the board of supervisors there is reported right now planning to make a survey of all court records in condemnation matters, compiling the sworn statements of valuations which property owners make in these cases. These would then be referred to the assessor for his guidance and would be produced when protests were made on tax assessments on these properties.

What price real estate? Well, it depends greatly on who is doing the appraising. And when. And why.—*Ventura County Star-Free Press*, April 5, 1940.

THE American Right of Way Association News highly commends Judge James L. Atteridge for his very timely statement made in dismissing the jury after it had rendered a verdict in the case "City of Santa Cruz vs. Wilson."

We also commend the publisher of the Santa Cruz Sentinel for giving the remarks of the judge headline attention on page one of the issue of February 20, 1940. It is hoped that more California newspapers will take up the defense of the already heavily-burdened taxpayer and exert their influence in stamping out the notorious practice of professional perjurers conducting themselves in the manner referred to in Judge Atteridge's comments.

It is to be hoped that the judges of the superior courts of the counties of California will likewise recognize this growing racket on the part of certain unscrupulous property owners and professional witnesses. We say "professional witnesses" because we would not honor these individuals with the term "expert witness" or "expert appraiser." We have reached a deplorable situation in the superior courts of this State when certain property owners can actually buy any type of valuation testimony they desire from certain so-called "experts," and their attorney will use such testimony.

Racketeering in connection with trials in condemnation proceedings for acquisition of private property for public use has grown into a profession in the larger metropolitan areas and is also flourishing in various counties in the State of California. It is, unfortunately, a growing evil which should be curbed by fair-minded juries and by courts with the courage of their convictions.

It is the purpose and aim of the American Right of Way Association to fight to the last ditch in its endeavor to eliminate these leeches who are attempting to bleed the last drop of blood out of the public treasuries.—*American Right of Way Association News*, April, 1940.



APPRECIATION

March 18, 1940.

Editor, California Highways
and Public Works
Sacramento, California

Dear Editor:

I have before me, two copies of your very fine journal, December 1939, and January 1940, showing the remarkable work under construction or completed by the department.

I have been so impressed by the many fine features in this little magazine that I am mailing these two numbers to my brother in Twin Falls, Idaho, who is quite interested in this work from a mechanical standpoint, whereas, my interest lays more in the scenic parts, etc.

I would greatly appreciate if I could be favored in receiving some more copies of your fine journal.

I am,

Very Truly Yours,

RALPH EMERSON WOODS,
106 Millar Avenue,
San Jose, California.

AN ENGINEER WRITES

CITY AND COUNTY OF
SAN FRANCISCO

Department of Public Works

Editor
California Highways
and Public Works
Sacramento, California

Dear Sir:

For some time past your official journal was regularly mailed to me, as I was engaged on highway work for the City of San Francisco as Designer and Civil Engineer.

Please return my name to your mailing list, if possible, as I find your magazine very interesting and instructive. I should especially appreciate it if you would send me a copy of the February and March issues, if available.

I wish to thank you for your past courtesies.

Very truly yours,

A. V. BOWHAY,
Assistant Engineer,
Room 367, City Hall.

UNITED STATES ASIATIC FLEET SUBMARINE SQUADRON FIVE U. S. S. CANOPUS (Flagship)

Manila, P. I., Feb. 6, 1940.

California Highways
and Public Works
P. O. Box 1499
Sacramento, California

Gentlemen:

While aide to the Commandant at the Navy Yard Mare Island, Cal., I received your monthly publication on California roads and development and upon my detachment it has continued to be sent me at 1034 Encino Row, Coronado. Since my departure from the coast in October it has been forwarded to me on the Asiatic Station.

Yours truly,

J. WILKES, U. S. N.
U. S. S. Pickerel
c/o Postmaster
San Francisco, Cal.
Comdr. U. S. Navy

San Francisco, Cal.,
March 23, 1940

California Highways
and Public Works
Sacramento, Cal.

Gentlemen:

I would greatly appreciate being placed on the list of subscribers for your very interesting publication of California Highways & Public Works. I have been able to borrow an issue occasionally but when a copy like that for March appears there is not even one to borrow. If possible, the March issue will be appreciated.

Yours very truly,

OSBORN ANDERSON,
Public Roads Admin.,
Federal Office Bldg.,
San Francisco, Cal.

California Highways
and Public Works
Sacramento, California

Gentlemen:

It has been my pleasure to receive California Highways for many years. I have always enjoyed it. So much, in fact, that it has always been passed on to others

after having examined it thoroughly from cover to cover.

One gentleman, in particular, is such a loyal fan that he protests when I delay in providing him with my copy. Would it be possible to have a copy mailed to him direct each month?

Very sincerely yours,

FLOYD TOWER,
315 Montgomery Street,
San Francisco, Cal.

California Highways
and Public Works
Sacramento, California

Gentlemen:

I just yesterday became cognizant of the publication by your Department of the magazine entitled "California Highways and Public Works." The issue I saw was the November issue and contains material of very great interest.

I think the plan and method of informing the citizens of your extensive and valuable efforts to be most worthy.

Will you kindly place my name on your mailing list beginning with the November number, and oblige

Yours very truly,

H. B. BLAKELEY,
Room 602, Hall of Records,
Los Angeles, California.

Department of Public Works
Sacramento
California

Dear Sirs:

I visit all of the high schools in Fresno County and in one of them I recently came across your Journal. I presume you are sending this to all the high schools and if so I wish to commend you on this very fine service.

If you can spare a couple more copies I would very much appreciate it if you would send both Superintendent Edwards and myself this particular issue and put us on your list for this very fine publication.

Sincerely yours,

LOUIS P. LINN,
Assistant Superintendent.

Funds For Additional Highway Projects Allocated By State

THE California Highway Commission has voted funds aggregating \$1,200,000 for inclusion in the State highway budget for the current biennium of eleven major construction projects, and allocating \$546,000 for 43 minor improvement and betterment projects.

When the budget was first prepared for the current biennium, it was based upon collections from the gasoline tax, diesel oil tax, and motor vehicle registration fees for the previous biennium plus the estimated normal increase from these revenues. During the present biennium, however, collections of revenue from the gas tax, registration fees, and diesel oil tax have shown greater increases than estimated at the time the budget was prepared.

It is on the basis of this greater increase of revenue and of savings accrued to Division of Highways funds because of advantageous bid prices on contracts which have been awarded by the Director of Public Works for State highway construction, that the Commission was able to vote funds for the \$1,200,000 in new major projects.

WILL IMPROVE BRIDGES

On a similar basis, the Highway Commission voted \$236,000 from diesel oil tax funds for reconstruction or improvement of five more bridges which are posted for restricted loads or speeds.

At the beginning of each biennial period, the Commission in adopting the State highway budget provides specified amounts for minor improvements and betterments on the State highway system. From time to time, the Commission allocates portions of these funds to specific small projects as the need for such betterment and minor improvement arises and proper season for the work arrives.

The \$1,200,000 voted for additional major construction projects provided for the following proposed work.

For grading, paving, and right of way on portions of Ramona Boulevard in Los Angeles County, between Mission Road and West Covina, Road VII-L.A.-26, \$200,000. This amount

supplements \$560,000 included in the budget for right of way and improvement to modern arterial standards of this heavily traveled suburban highway.

For grading and paving the Coast Route in Santa Clara County between Llagas Creek and Gilroy, IV-SCL-2-C, \$175,000. This will provide for the continuation to Gilroy of the three-lane pavement which has been constructed south from San Jose as far as Llagas Creek.

An amount of \$150,000 for constructing a bridge and approaches across the Kern River at the westerly entrance of Bakersfield, VI-Ker-58-L, of the secondary State highway between Bakersfield and the Coast Route at Santa Margarita.

For paying the 7.3 miles of relocation of U. S. 40 in Solano and Yolo counties between 1.3 miles north of Dixon and 1 mile east of Davis, X-Sol-Yol-7.6-L.A.E, the sum of \$140,000. A contract is now in progress for grading this new section of the main highway between Sacramento and San Francisco, and bids will be opened May first for construction of a grade separation near Davis. Future contracts will be let for construction of two bridges within the limits of the project.

For constructing a structure separating the grades of the El Camino Real (U. S. 101) and University Avenue, IV-SCL-2-A, at the entrance of Stanford University at Palo Alto, the amount of \$78,000. This structure is estimated to cost \$170,000 and the city of Palo Alto will furnish \$92,000 from its share of $\frac{1}{4}$ -cent gas funds.

An amount of \$71,000 for grading and surfacing on Bellflower Avenue in Los Angeles County, between Spring Street and Arteria, VII-L.A.-169-A.

In Kern County, funds in the amount of \$100,000 were voted for grading and surfacing portions of the secondary route which leads northerly from Famoso to Porterville, between Famoso Road and the North County Boundary, VI-Ker-129-B.

For grading and surfacing a portion of the State highway which leads from Baker in San Bernardino Coun-

ty to Death Valley, the sum of \$45,000 to be used between the south boundary of Inyo County and Shoshone, IX-Iny-127-P

OTHER APPROPRIATIONS

For further improvement to the State highway which leads from Fresno to General Grant Park and the Kings River Canyon, an additional amount of \$81,000 was voted, making a total of \$217,000 budgeted, for grading and surfacing between Squaw Valley and a connection with the existing road in the National Forest, road VI-Fre-41-T,U.

The sum of \$75,000 was voted for additional grading and surfacing in Los Angeles and Ventura counties on the Santa Paula lateral, VII-L.A.-Ven-79-Various locations.

In Orange County, for the Main Street Extension, between Route 60 and Route 43, at Newport Beach, VII-Ora-184-A,NptB, \$85,000 was voted to supplement the \$75,000 in the budget. The work will include grading, surfacing and a bridge across Newport Bay.

The \$236,000 from additional diesel oil tax funds for reconstructing or strengthening posted bridges which was voted at the meeting of March 29 included allocations to the following projects:

In Mendocino County, bridges across Ferguson Gulch and McNamee Creek, I-Men-56-A, will be replaced by fills and culverts; \$65,000 is provided for this work. On the same route in Mendocino County the bridge at Greenwood Creek, I-Men-56-C, will be reconstructed for \$21,000.

The sum of \$90,000 was provided for the bridge and approaches across the San Gabriel River in Los Angeles County on Artesia Boulevard, VII-L.A.-175-B. Also in Los Angeles County, between West Covina and Azusa, \$40,000 was allocated for bridge and approaches across Dalton Wash, road VII-L.A.-62-D.

In San Luis Obispo County, \$20,000 was allocated for bridge and approaches across Arroyo Grande Creek, V-SLO-56-E, on the secondary highway between Pismo and Guadalupe.

Colorful Scenes at Dedication

(Continued from page 2)

Warren Shannon, President Board of Supervisors and President Golden Gate Bridge and Highway District; Paul E. Mudgett, President Redwood Empire Association; Colonel Thomas A. Terr, 9th Corps Area of the Presidio; Lawrence Barrett, Chairman California Highway Commission, speaking for the entire Commission; State Director of Public Works Frank W. Clark, officially representing Governor Olson; The Honorable Hector M. Escalona, Consul General of Mexico; E. G. Rowebottom, Minister representing Provincial Government of British Columbia, Canada; Miss Martha Sprague, daughter of and officially representing Governor Charles H. Sprague of the State of Oregon; Kenneth Godwin, Western Director of Public Works Administration, officially representing the President of the United States and PWA Administrator Carmody of Washington, D. C.; Alfred J. Cleary, Chief Administrative Officer, representing Mayor Angelo J. Rossi, who was ill in the hospital; Assemblyman Thomas Maloney, Chairman of the San Francisco legislative delegation; and William O. Thorniley, Seattle, Olympic Peninsula, representing Governor Clarence Martin of Washington.

Spokesmen for the Nineteenth Avenue Dedication were: Major J. Gordon Smith, Commissioner for the Provincial Government of British Columbia, Canada; The Consul General Escalona of Mexico; Miss Martha Sprague, representing the State of Oregon; William R. Lawson, State Director of Works Progress Administration; Fred Beer, President California Mission Trails Association; Leo Hemmett, President Alta-California Incorporated; Mr. Mudgett, President Redwood Empire Association; Clyde Healy, Assistant City Engineer, San Francisco; Chief Administrative Officer Cleary; Chairman Barrett of the California Highway Commission; and William O. Thorniley, Seattle, Olympic Peninsula representing Governor Clarence Martin of Washington.

Smith: You say you flunked that course again? How come?
Jones: Well, what do you expect? They asked the very same questions again.

Heavy April Traffic on Bay Bridge

APRIL proved to be another month of heavy traffic on the San Francisco-Oakland Bay Bridge, Director of Public Works Frank W. Clark reported to Governor Olson. The total number of vehicles crossing fell just under the one million mark.

The increase over the same month a year ago was 114,487 vehicles, or 13.5 per cent. If the exposition traffic last April is eliminated, the net bridge traffic shows an increase of 256,560 vehicles, or 37.8 per cent.

The total vehicular revenue was less in April, 1940, than a year ago by \$84,879.

April traffic on the San Francisco-Oakland Bay Bridge and comparative figures are:

	April 1940	April 1939	March 1940	Total since opening
Passenger autos and auto trailers -----	874,469	767,327	879,559	30,966,127
Motorcycles and tricars----	3,788	3,467	3,301	141,961
Buses -----	17,970	16,407	17,990	508,761
Trucks and truck trailers---	49,231	44,790	46,612	1,497,674
Others -----	18,346	17,326	16,898	530,242
Total vehicles -----	963,804	849,317	964,360	33,644,765

Snow Survey Assures Ample Water Supply

(Continued from page 5)

agricultural Delta of the Sacramento and San Joaquin Rivers will be negligible this summer. The two high stream flow periods, one at the end of February and the other at the end of March, flushed from the Delta stream channels the last lingering remnants of the salinity that had gained a foothold during the low water period of last summer. Suisun Bay is now flushed out and fresh water extends down as far as Carquinez Bridge. To again penetrate into the Delta the salinity has a long upstream fight and with the low water flow of the two great rivers promising to be three times as great as it was last year the salt water will probably only reach the very lowest sections of the rivers on each side of Sherman Island. Irrigation of the fertile Delta lands from the sloughs and channels surrounding the islands should be permissible with perfect safety until the end of the irrigation season.

A tabulation of all the snow measurements, together with forecasts of flow from most of the Sierra watersheds, are contained in the Snow Survey Bulletin issued by the Division of Water Resources on April 10th. Copies of this bulletin may be had from the Division upon request.

New Sidehill Viaduct Will Break Bottleneck on Santa Cruz Highway

(Continued from page 12)

by the same method. These operations are undertaken as infrequently as practicable, allowing the preparatory work to run several weeks between pours of concrete, in order to reduce interference to public traffic as much as possible.

No work is permitted on Saturdays, Sundays or holidays that could interfere with traffic flow, as the narrow roadway is at best considerably below demand. It is anticipated that the project will be completed in August, 1940. Heafey Moore Company and Fredrickson Watson Construction Company have the contracts for both units of the project.

Cement Experiments Through the Ages

By LESTER C. MEDER, Assistant Physical Testing Engineer

The following is the second of a series of articles on the history, manufacturing processes, testing, and types of Portland cement. The first article briefly summarized the history of cement, the winning and preparation of the raw materials up to the stage where they were ready to be burned into cement clinker.

FIGURE 1 shows a typical flow sheet for the entire manufacturing process. Figure 2 shows, in detail, the temperatures developed and the reactions or changes that take place in the kiln.

By following Figure 2 along with the text, it will be possible to get a clearer picture of the process.

As mentioned, a slurry of the raw materials mixed with 30 per cent to 40 per cent of water enters the kiln. As this slurry moves slowly forward, motivated by the rotation of the kiln, the drying material is picked up by chains that assist in transferring the heat from the ignited gases to the mix, thereby aiding in the evaporation of the free water.

As long as there is an appreciable amount of free water present, the temperature can not rise above 212 degrees Fahrenheit, the boiling point of water.

After the free water has all been evaporated, the temperature of the mass rises rapidly to 840 degrees Fahrenheit, at which temperature the magnesium carbonate is calcined, with the loss of carbon dioxide, a gas.

As this compound is an impurity, and present only in limited amounts, it affects the heating rate but little. As the temperature increases beyond this point, the chemically fixed water in the clay is driven off, and there is a definite change in that material.

When the temperature of the mass reaches about 1650 degrees Fahrenheit, the limestone is decomposed or calcined with the loss of carbon dioxide, or chemically speaking—

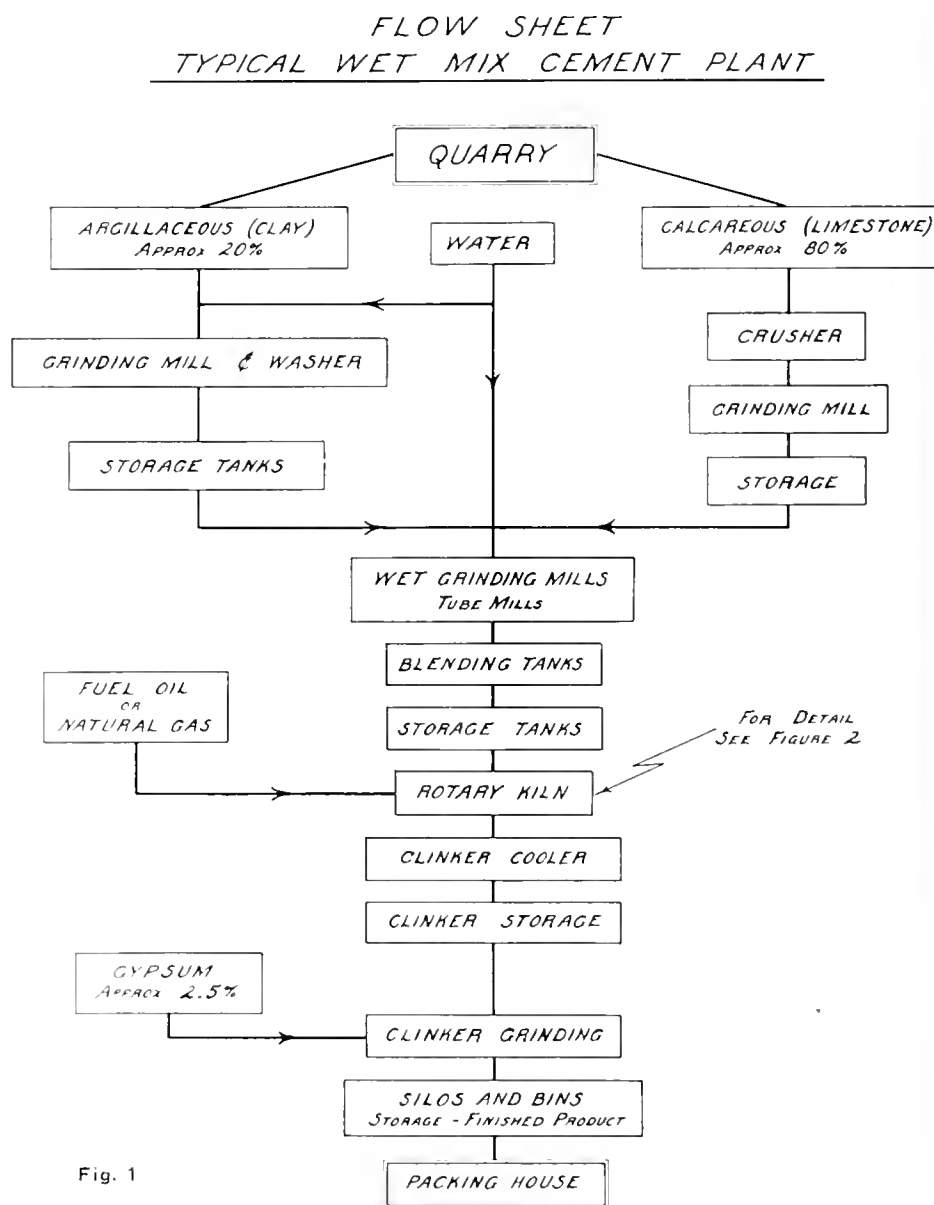


Fig. 1

As the clay and limestone are being broken up, they are constantly recombining with each other to form new compounds. At first the speed of these reactions is

slow, but as the temperature increases, the reaction speeds increase greatly. It must be remembered that while the silica is very inactive at low temperatures, it acts as

a strong acid anhydride at high temperatures, and readily combines with the lime which is basic in character. These reactions form, in turn, the mono-calcium silicate, then the di, and finally the tri-calcium silicate. At about the time these reactions are progressing, some of the calcium oxide is reacting with the alumina and iron oxide to form the calcium aluminates and calcium alumina ferrites that can be petrographically identified in cement clinker. These reactions can be readily followed by reference to Figure 2.

Contrary to popular belief, the raw materials are not completely melted in the manufacture of clinker. In fact only a small percentage of material is actually melted. The first indication of melting occurs at about 2300 degrees

Fahrenheit. At this point there is a considerable shrinkage, known as the "Naeken Shrinkage," and named after the first observer, Naeken. At this point, a ring of the material adheres to the wall of the kiln, and forms a semibarrier by cementing or sticking to the higher melting point compounds. This is known as the "liquid ring."

The percentage of melt is roughly proportional to the amount of iron, aluminum, magnesium and alkali oxides present in the mix.

As this mixture of 30-40 per cent sticky liquid with 70-60 per cent solid materials moves slowly toward the discharge end of the kiln the major reactions come to completion. The clinkered material then passes out of the influence of the primary gases, or gases from the flame, and into the influence of

the secondary gases, or the cold air entering the kiln directly. This rapidly cools the clinker. At the point where the liquid freezes, or solidifies, there is formed the "nose ring," a semibarrier similar to the liquid ring described above.

The formation of these rings sometimes causes considerable trouble, particularly when the clinker is being made from a mix that contains considerable fluxing material, or low melting oxides. Ring formation or growth can sometimes be controlled by adjusting the length of the flame. If this fails the "nose ring" can be spaded out manually by the use of heavy steel spades with long handles, and the liquid ring can be shot out by heavy projectiles fired from a special, large caliber gun. In extreme cases, the kiln must be stopped, cooled

(Continued on page 29)

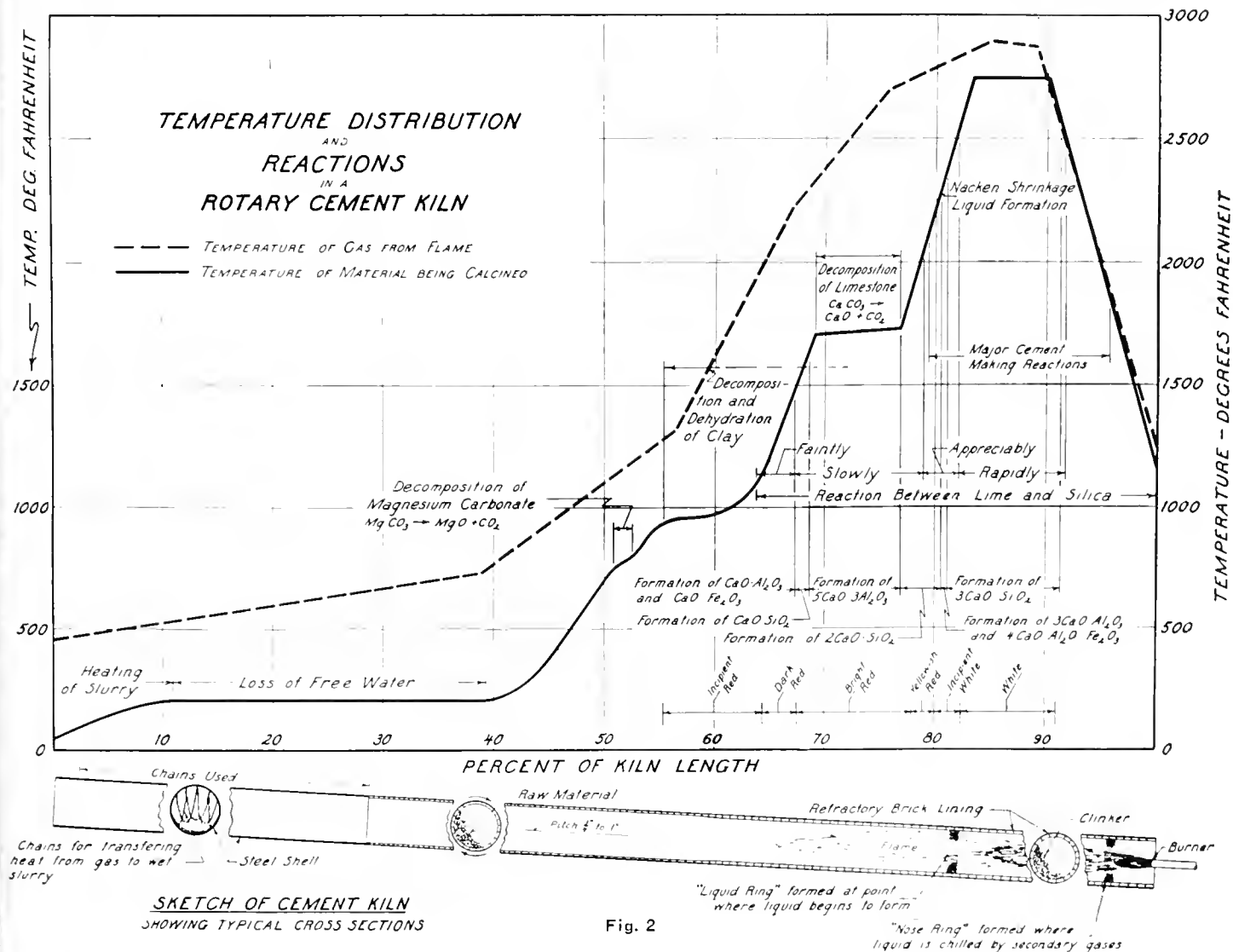


Fig. 2



Typical stretch of recently realigned highway between Lake Britton and Burney Falls on Sierra Way.

Picturesque Forest Highway

By E. J. BASSETT, District Office Engineer

WITH the completion of the California Forest Highway project on the Mt. Shasta-Mt. Lassen National Forest Highway, from a point 5 miles north of the junction of State Highway Routes 83 and 28 to a point near Cayton, the last link of Forest Route 77 was made available to the public.

This route is the most northerly section of the Sierra Way, a scenic highway, which, when completed in its entirety, will follow the Sierra Nevada Mountains from Mt. Shasta City to a point near Bakersfield, affording ingress to a great variety of recreational areas for those seeking pleasure trips, hunting, fishing, snow sports and rest. It will make access to the Lassen Park loop in Lassen Volcanic National Park much easier for visitors from the north and northeast.

Consisting of three separate contracts, construction on California Forest Project 77-J, was started in

August, 1937, when the contract for grading the 5-mile unit was awarded to A. Teichert & Sons, Inc., of Sacramento. The work consisted of grading a 30-foot roadway preparatory to subsequent surfacing operations, involving the handling of 142,100 cubic yards of roadway excavation and 15,000 cubic yards of imported borrow, the latter being used principally over short sections of shallow fills where it was impracticable to use the heavy rock excavation common to this volcanic region.

In addition to the grading items, drainage structures consisting of corrugated metal pipes varying from 18 to 36 inches in diameter were placed throughout the project.

BRIDGES CONSTRUCTED

A reinforced concrete rigid frame bridge with a span of 38.42 feet and a clear roadway of 24 feet was constructed across Cayton Creek. The hand-rail is of redwood timber sup-

ported by concrete posts cast with the curb.

The grading project was completed in July, 1938, at a cost of \$128,991.24, including engineering. Boyd E. Sylvester, Chief Engineering Inspector Superintendent of the Bureau of Public Roads, was Resident Engineer for the project.

During approximately the same period, Project 77-J1, involving construction of a steel bridge across Lake Britton, an artificial lake formed by the Pacific Gas & Electric Company's Pit 3 dam across the Pit River was in progress at a point known as "The Narrows." Awarded to C. J. Montag & Sons, of Portland, Oregon, work was started in August, 1937, and completed in October, 1938.

The bridge, as constructed, consisted of two 40-foot approach spans and a 500-foot steel span made up of a 100-foot anchor arm at each end, two 75-foot cantilever arms, and a

(Continued on page 28)



Upper—New bridge across Lake Britton. Lower—Looking northwesterly down grade towards Pit River Bridge across Lake Britton

Highways Need More Federal Aid

(Continued from page 1)

property which is to be benefited is destroyed. A revenue bond issue through private capital is likewise out of the picture.

GAS TAX REVENUES LARGE

What is wrongly referred to as a "gas" tax, we look upon as a service charge for the use of the highways. The service charge for the use of our highways produces annually in California approximately \$17,000,000 to the Federal Government. This service charge as represented here is paid by the population largely in the low-income brackets.

The Federal Government collects nationally a total of \$300,000,000 to \$350,000,000 annually from this "gas tax" or service charge on the use of State highways, exclusive of the Federal excise tax, which the motorist pays on parts, tires, oil and other commodities. This service charge is willingly paid, the same as the State service charge, for the use of roads, provided this fund is used exclusively for the improvement and development of our highway transportation system.

We are all penalized for diversion of highway funds by the Federal-Aid Highway Act so that all this money, since the passage of the Hayden Cartwright Act, goes into the highway transportation system. We in California, by constitutional provision, can not use it for other purposes.

The great need in this national system, and particularly in metropolitan areas, would seem to justify an increase in the Federal Aid to the States rather than discussion of a decrease. It is only fair and just that the Federal Government use these funds in the development of this system. This is practically the only successful pay-as-you-go transportation enterprise in existence and this development can go on as a pay-as-you-go proposition if the Federal Government sees that this great service charge fund gets back exclusively into the transportation system.

The State of California has contributed to the Federal-Aid Highway System since 1926 approximately \$35,000,000 for right of way, at the same time receiving

Federal Aid of approximately \$95,000,000. These figures are cited to show that, while the popular belief is that Federal Aid is on the basis of a 50-50 cooperation, the contribution for right of way is a real financial contribution to the building of a national system of highways. Other States have had similar experience. We feel that the Federal Government is doing a great deal for us and it is not set forth to show we are not appreciative of it but to show the actual situation and the financial relationship between the State and the Federal Governments.

In most States the greater portion of the gasoline tax originates within the cities, because of the larger registration in these urban areas. In the case of California, this State contributes from the one-cent Federal gasoline tax a total of \$34,000,000 biennially or \$17,000,000 annually and receives returns from Federal highway aid some \$8,000,000 annually (4-year average 1938-1941 fiscal years).

METROPOLITAN PROBLEM

We recognize the fact that we must have a national system and we are not criticising the return to States which receive less than they produce, but we do feel the spread is a little large unless we can have some relief from the Federal Government toward our metropolitan problem.

Now we are asking that, in these metropolitan areas, the Federal Government assist in bringing about a solution of a problem that no State or city can solve by voting property bonds. The handling of this solution should be through the proper road organization of the Federal Government in coordinating its entire Federal Aid System, of which these connecting city streets are an integral part. Furthermore, unemployment, to a large extent, exists in these metropolitan areas, and money spent in this manner would bring about much relief.

In our opinion, Federal Aid has been of mutual assistance from the standpoint of both the States and the Federal Government. We are making full use of Federal Aid in placing approved projects under contract.

As the appropriations become available, we will show a favorable record of expenditure of these funds by the time the next appropriation is authorized by Congress.

PLANNING SURVEY

California is faced, like many of the other States, with the problem of obsolescence of our highways due to increase in the speed of the motor vehicles, the increase in numbers, and our increase in population, to a minor extent. The United States Bureau of Public Roads, now known as the Public Roads Administration, cooperated in a state-wide planning survey covering a study of the entire system.

The facts developed in this study revealed that, upon the completion of our present State system, replacement of the rural State Highway System, due to obsolescence and depreciation, is falling behind at the rate of 151 miles of road surface and 38 bridges each year. The question is a serious one, involving this consideration, as well as one of multiple lanes to care for the increased traffic volume and increased population.

Roads in California, as in other States, are of national importance. Recently, the Army took over part of our system south of San Francisco for Army maneuvers. This road south of San Francisco in the Santa Cruz area was temporarily closed to public use, which shows the importance of highways in a national defense plan. This road is a part of the Federal-Aid Highway System and was constructed with Federal and State funds. This indicates the part played by a well-laid-out system of highways in maneuvers which the Federal Government has seen fit to inaugurate.

The second installment of Mr. Purcell's article will appear in the June issue of this magazine.—Ed.

Teacher: "Who can tell me what the former ruler of Russia was called?"

Class (in unison): "Tsar."

Teacher: "Correct; and what was his wife called?"

Class: "Tsarina."

Teacher: "What were the Tsar's children called?"

There was a pause and then a timid voice in the rear piped up: "Tsardines."

Highway Bids and Awards for the Month of April, 1940

BUTTE COUNTY—Across Butte Creek overflow, about 12 miles northwest of Biggs, construction of a reinforced concrete slab bridge. District III, Route 45, Section A. C. A. Dunn, Klamath Falls, Oregon, \$18,367; Engineers, Ltd., Sacramento, \$21,879. Contract awarded to M. A. Jenkins, Sacramento, \$16,391.

BUTTE AND TEHAMA COUNTIES—Between Pine Creek and Singer Creek about 0.5 mile to be graded and surfaced with plant-mixed surface. District III, Route 3, Sections D.A. Piazza and Huntley, San Jose, \$17,183. Contract awarded to Claude C. Wood, Lodi, \$14,828.

GLENN COUNTY—Across Sacramento River Overflow, one mile east of Butte City, construction of a reinforced concrete slab bridge. District III, Route 45, Section C. Harold Smith, St. Helena, \$13,255; C. A. Dunn, Klamath Falls, \$13,843. Contract awarded to M. A. Jenkins, Sacramento, \$13,235.

KERN COUNTY—At various locations between Mojave and Ricardo and between 1.6 miles and 4.3 miles west of Mojave, about 8.4 miles to be graded and surfaced with plant-mixed surfacing. District IX, Kern County, Routes 23, 58, Basich Bros., Torrance, \$62,591; E. L. Yeager, Riverside, \$68,132; R. E. Hazard & Sons, San Diego, \$69,719; Valley Construction Co., San Jose, \$76,913. Contract awarded to G. W. Ellis, North Hollywood, \$60,023.

LOS ANGELES COUNTY—On Rosemead Blvd., between Fairview Avenue and Locksley Drive, about 0.2 mile roadbed graded, surfaced with plant mix and road-mix and surface treatment. District VII, Route 168, Section C. A. S. Vinnell Co., Alhambra, \$9,603; Geo. J. Bock Co., Los Angeles, \$9,864; Dimmitt & Taylor, Los Angeles, \$10,074; Griffith Co., Los Angeles, \$10,347. Contract awarded to Vido Kovacevich, South Gate, \$9,406.

LOS ANGELES COUNTY—Over Arroyo Seco Parkway at Meridian Avenue, a reinforced concrete bridge to be constructed and the approaches to be paved with portland cement concrete. District VII, Route 205, S.Pas. Oscar Oberg, Los Angeles, \$22,412; I. E. Haddock, Ltd., Pasadena, \$22,471; Oberg Bros., Los Angeles, \$22,719; Wm. J. Distel, Los Angeles, \$23,297; Row Construction Co., Pasadena, \$23,664; Contracting Engineers Co., Los Angeles, \$24,326; Carlo Bongiovanni, Los Angeles, \$24,855; Dimmitt & Taylor, Los Angeles, \$24,992; A. S. Vinnell Co., Los Angeles, \$25,912; Byerts & Dunn, Los Angeles, \$26,449; Claude Fisher Co., Los Angeles, \$27,092; Chas. J. Dorfman, Los Angeles, \$27,790; Fred E. Potts Co., Los Angeles, \$28,652; V. L. & W. B. Jacobson, Los Angeles, \$29,979; Baruch Corp., Los Angeles, \$30,813. Contract awarded to J. S. Metzger, Los Angeles, \$22,252.

MARIN COUNTY—Between Myrtle Avenue in San Rafael and San Quentin Wye, about 1.3 miles to be graded and surfaced with plant-mixed surfacing. District IV, Route 1, S.Rf. A. G. Raisch, San Francisco, \$134,735; Lee J. Immel, Berkeley, \$137,286; M. J. B. Construction Co., Stockton, \$147,186; Guerin Bros., San Francisco, \$159,004. Contract awarded to Chas. L. Harney, San Francisco, \$131,259.

MENDOCINO COUNTY—Between Outlet Creek and Reeves Creek, about 4.5 miles to be surfaced with plant-mixed surfacing. District I, Route 1, Section F. Independent Construction Co., Ltd., Oakland, \$37,902; I. R. Reeves, Sacramento, \$39,842; Claude C. Wood, Lodi, \$41,957; Oranges Bros.,

Stockton, \$42,213; Piazza & Huntley, San Jose, \$43,282; A. G. Raisch, San Francisco, \$14,584; L. A. Briscoe, Arroyo Grande, \$16,736; E. A. Forde, San Anselmo, \$50,638. Contract awarded to Marshall S. Hanrahan, Merced, \$36,136.

MENDOCINO COUNTY—Portions between Wendling and Yorkville, about 2.5 miles to be graded and an armor coat applied. District I, Route 48, Sections B.A. Valley Construction Co., San Jose, \$74,637; Piombo Bros., San Francisco, \$79,511; J. L. Conner and Sons, Point Arena, \$79,867; Louis Biasotti & Son, Stockton, \$80,108; Harold Smith, St. Helena, \$86,200; Guerin Bros., San Francisco, \$87,389; Frederickson Bros., Emeryville, \$87,402; Scheumann & Johnson and John Burman & Sons, Eureka, \$90,927; Chas. L. Harney, San Francisco, \$91,722; McNutt Brothers, Eugene, Ore., \$97,237. Contract awarded to Parish Bros., Hollywood, \$73,523.

MONO COUNTY—At Grant Lake, about 4 miles to be graded and road-mix surface treatment applied. District IX, Route 111, Section A. Claude C. Wood, Lodi, \$60,441; A. S. Vinnell Co., Alhambra, \$63,122; Basich Bros., Torrance, \$77,069. Contract awarded to Isbell Construction Co., Reno, \$59,424.

MONO COUNTY—Between West Walker River and Route 23, about 2.3 miles to be graded and road-mix surface treatment applied. District IX, Route 13, Section A. Claude C. Wood, Lodi, \$42,353; Isbell Construction Co., Reno, \$43,383; Rexroth & Rexroth, Bakersfield, \$43,656; A. S. Vinnell Co., Alhambra, \$46,534. Contract awarded to Basich Brothers, Torrance, \$38,125.

MONTEREY COUNTY—At Big Sur River 29 miles south of Monterey, a reinforced concrete bridge to be constructed and about 0.27 mile of approaches to be graded and road-mix surface treatment applied. District V, Route 56, Sections E.F. Scheumann & Johnson, Eureka, \$34,714; Albert H. Siemer & John Careano, San Anselmo, \$38,911; Caputo & Keeble, San Jose, \$39,165; Trewhitt-Shields & Fisher, Fresno, \$39,459; Harry J. Oser, San Francisco, \$39,880; E. T. Lesure, Oakland, \$41,234; R. G. Clifford, San Francisco, \$45,995. Contract awarded to Victor L. & Wm. B. Jacobson, Los Angeles, \$32,773.

RIVERSIDE COUNTY—Between Route 19 and Banning, about 6.1 miles to be graded and surfaced with plant-mixed surfacing on cement stabilized base. District VII, Route 26, Sections A.Bau, I.Bau, Griffith Co., Los Angeles, \$159,224; Matich Bros., Elsinore, \$164,934; Warren Southwest, Inc., Los Angeles, \$168,259; Claude Fisher Co., Ltd., Los Angeles, \$168,721; Basich Bros., Torrance, \$173,687; Daley Corp., San Diego, \$179,135; V. R. Dennis Construction Co., San Diego, \$179,316; A. S. Vinnell Co., Alhambra, \$184,611; Geo. Herz & Co., San Bernardino, \$194,022; Dimmitt & Taylor, Los Angeles, \$205,320. Contract awarded to Oswald Bros., Los Angeles, \$155,667.

SACRAMENTO COUNTY—Between Isleton and Walnut Grove, about 8.1 miles to be graded, existing pavement widened with crusher run base and portions resurfaced with plant-mixed surfacing. District III, Route 11, Section D. J. R. Reeves, Sacramento, \$62,566; E. A. Forde, San Anselmo, \$65,772; Heafey-Moore Co.-Frederickson & Watson Construction Co., Oakland, \$66,761; Lee J. Immel, Berkeley, \$67,392; M. J. B. Construction Co., Stockton, \$68,391; Independent Construction Co., Ltd., Oakland, \$69,434; A. Teichert & Son, Sacramento, \$69,470; A. G. Raisch, San Fran-

cisco, \$72,121; Chas. L. Harney, San Francisco, \$77,516. Contract awarded to Jones and King, Hayward, \$61,612.

SAN DIEGO COUNTY—Across San Diego River near Lakeside, a reinforced concrete bridge 1010 feet in length to be constructed. District XI, Route 198, Section B. M. H. Golden, San Diego, \$89,465; V. R. Dennis Construction Co., San Diego, \$93,961; Sordal & Bishop, Long Beach, \$95,610; Byerts & Dunn, Los Angeles, \$97,784; A. Soda & Son, Oakland, \$98,460; J. S. Metzger & Son, Los Angeles, \$99,500; Macco Construction Co., Clearwater, \$101,532; Contracting Engineers Co., Los Angeles, \$105,968; J. E. Haddock, Ltd., Pasadena, \$109,927; Griffith & Co., Los Angeles, \$111,832; Carlo Bongiovanni, Los Angeles, \$131,532. Contract awarded to B. G. Carol & Harry L. Foster, San Diego, \$89,132.

SHASTA COUNTY—A reinforced concrete bridge and approaches across Olney Creek, 3.6 miles south of Redding to be constructed. District II, Route 3, Section A. Scheumann & Johnson, Eureka, \$16,736; E. E. Smith, Eureka, \$16,946; Harold Smith, St. Helena, \$17,029; R. M. Price, Huntington Park, \$17,126; James E. Anderson, Visalia, \$18,405; A. T. Beckett, Oakland, \$20,192. Contract awarded to A. Frederick Anderson, Oakland, \$16,435.

SHASTA AND SISKIYOU COUNTIES—Between Antler and Big Canyon, about 32 miles, screenings to be stock piled. District II, Route 3, Sections C.D.A. Hein Bros. Basalt Co., Redding, \$13,253; Hayward Building Material Co., Hayward, \$14,503. Contract awarded to Shea & Beebe, Hawthorne, Nevada, \$11,453.

SOLANO COUNTY—Constructing highway embankments on various sections between 1.2 miles north of Rio Vista and Ryer Island Ferry. District X, Route 99, Section A. Claude C. Wood, Lodi, \$5,320; C. C. Steele, Rio Vista, \$5,390; Sheldon Oil Co., Suisun, \$5,530. Contract awarded to Oranges Bros., Stockton, \$5,320.

SOLANO COUNTY—Construct one ferry ramp and repair ferry hull at Cache Slough and construct two ferry ramps and repair ferry hull at Steamboat Slough. District X, Routes 99, 100, Section A.A. Pomeroy Sinnock, Stockton, \$9,499; Frank Legg, San Francisco, \$13,603. Contract awarded to F. Kaus, Stockton, \$7,583.

TEHAMA COUNTY—Between Red Bluff and six miles north about six miles to be graded and surfaced with a cement stabilized base and a plant-mixed surfacing and two reinforced concrete bridges to be constructed. District II, Route 3, Section C. United Concrete Pipe Corp., Los Angeles, \$217,489; Frederickson & Westbrook, Sacramento, \$218,582; Heafey-Moore Co., Frederickson & Watson Construction Co., Oakland, \$223,729; Granfield, Farrar & Carlin, San Francisco, \$227,887; A. Teichert & Son, Inc., Sacramento, \$228,477; The Utah Construction Co., San Francisco, \$249,877; Eaton & Smith, San Francisco, \$250,796; McNutt Bros., Eugene, Oregon, \$297,004. Contract awarded to Jones & King, Hayward, \$210,291.

YOLO COUNTY—Causeway across Yolo By-Pass about 5 miles west of Sacramento, the south half to be redecked. District III, Route 6, Section B. E. E. Smith & N. M. Ball Sons, Berkeley, \$115,479; M. J. B. Construction Co., Stockton, \$118,545; Heafey-Moore Co.-Frederickson & Watson Construction Co., Oakland, \$119,887; Campbell Construction Co., Sacramento, \$119,953; MacDonald & Kahn, Inc., San Francisco, \$128,192. Contract awarded to Lee J. Immel, Berkeley, \$111,870.

Highways Built for Mobility and Safety

(Continued from page 17)

The analysis of 236 reported traffic studies and the results accomplished by corrective measures completed, in so far as accidents are concerned, seem to indicate that accidents have been reduced in these definite locations approximately 36 per cent over the previous year.

In many cases simple corrections were made, the installation of an



YOU'LL MAKE BETTER TIME with SAFETY

National Safety Council

additional sign, more definite and carefully planned striping, the installation of lights or signals, correction in surfacing, changes in alignment and grade, installation of guard rail, changes of superelevation on curves so as to make it more easily traversed, installation of channelization, and, in two cases, the mere trimming of trees has eliminated hazardous, blind locations.

Experience writes the definition of traffic safety for the highway engineer. The California Division of Highways is utilizing all the experience available, deriving that experience from careful observation and detailed study of accident records.

The Division of Highways is com-

Picturesque Forest Highway

(Continued from page 24)

150-foot suspended central span. The lower chords of the central sections were designed in the shape of an arch for appearance.

Excavation for the four piers was accomplished through the use of steel sheet piling, unwatering being accomplished with electric and gas pumps. Piers were founded on solid rock except for one small gravelly area where steel rails were driven as an added precaution. Concrete was placed under water by means of bottom dump buckets using a Class "A" mix.

The anchor piers of reinforced concrete support one end of the approach spans. The two main piers, also of reinforced concrete, were founded under water with the deck level 67 feet above average lake level. The deck is of light-weight reinforced concrete with a 24-foot clear roadway and two 2.5-foot sidewalks.

The erection of structural steel was handled by means of a high line consisting of a 1½-inch main cable with an 850-foot span. Practically all members were erected in pairs using a heavy timber spreader. The two halves of the suspended span were placed as cantilevered continuations of the cantilever arms. The tension in the top chords and compression in the bottom chords set up during this operation were carried across the ends of the suspended span by jacks set in telescopic chord members. The jacks were set in a neutral position when the telescopic members were erected. However, little jacking was necessary, the central points meeting very well as the steel lay. Priming up of both chords in both trusses was done within a few hours and the jacks released, converting the central 150-foot section of steel into a simple suspended span. The placing of the steel structure required 8 weeks.

The cost of the bridge structure was \$201,491.22, including engineering.

Mr. H. P. Hart, Associate Structural Engineer for the Bureau, was Resident Engineer.

mitted to a program of the construction of safe highways for careful drivers within the limits of the funds available—as provided by the motorists of the State.

TWELVE MILES OF ROAD

The third and last unit of construction, California 77-E5, H2, J2, consisted of the surfacing and sealing not only of the Lake Britton section, but two adjacent units to the north of Cayton. This project covered 12.2 miles in all, 5.0 miles of which were on Section J.

This work involved the placing of a 5-inch compacted base course consisting of 2-inch heavy crushed rock over the full subgrade section; a 3-inch compacted crusher-run surface course; and a bituminous surface course consisting of 25 pounds of ½-inch crushed rock and .22 gallons 90-95 liquid asphalt as the first application, and 10 pounds of ¾-inch crushed rock and .13 gallons of asphalt as the second application. The full thickness of pavement was used on parking areas, road approaches, and on a foot-path at the southerly end of Lake Britton bridge. The bituminous treatment was extended to roadway dykes at various locations.

On the remaining seven miles of the project where a base course had been placed under previous contracts the surface course and surface treatment only were applied. Final cost figures are not at present available, but the bid sheets indicate that the cost approximated \$106,635, exclusive of engineering.

Hemstreet & Bell, of Marysville, were the contractors constructing the project. Mr. J. E. Wood, of the Bureau, was Resident Engineer.

UTAH ASKS FOR MAGAZINE

The State of Utah
State Road Commission
Salt Lake City

Mr. Frank W. Clark, Director,
California Highways and Public Works,
P. O. Box 1499,
Sacramento, California.

Dear Sir:

I would be very glad to have my name placed on the mailing list and receive the California Highways and Public Works magazine, as published each month.

Very truly yours,

L. WENDELBOE,
Mgr. Planning Survey.

The Evolution of Cement

(Continued from page 23)



This is a typical California cement plant situated at Redwood City

down, and men sent in to break out the mass.

PROCESS AND REACTIONS

A summary of the processes and reactions:

1. Evaporation of free water.
2. Dissociation of magnesium carbonate.
3. Release of combined water from the clay.
4. Dissociation of calcium carbonate.
5. Combination of lime and clay.

or, briefly drying, heating, decomposition, and reaction.

As the clinker reaches the end of the kiln it falls in a fiery cascade of small particles ranging from dust to two or three inches in diameter into the clinker cooler.

There are two fundamental theories that govern the method of cooling. One theory is that clinker should be cooled as rapidly as possible. Rapid cooling is accomplished by quenching the clinker with great drafts of cold air, or

caseading it in revolving steel cylinders cooled with a spray of cold water. In other cases it is dumped in piles from buckets on endless chains, to be lightly sprinkled with water, and in extreme cases it is quenched by dumping into water, from where it is dragged by conveyor buckets.

The second theory is that the clinker should be cooled as slowly as possible in order that crystal compounds may come more completely to equilibrium. In carrying out this theory, the clinker is dropped into a secondary kiln and the temperature is raised by a partially atomized oil flame which generates a strong reducing atmosphere. The reducing atmosphere materially lowers the softening point of the clinker and allows high temperature reactions to continue. The clinker enters such a cooler at about 2450 degrees Fahrenheit, remains in it about an hour, and is discharged at about 1850 degrees Fahrenheit. At this stage it is lightly quenched with water, and then stockpiled.

When all operations are properly

conducted excellent cement is made under either of these widely divergent cooling methods. The proponents of each method claim certain advantages in subsequent grinding. Easier grinding means cheaper grinding, and as clinker grinding is perhaps the second most expensive process in cement manufacture, any reduction of the cost of this operation is of major importance.

After the cement passes through the coolers it is stockpiled for storage until it is ground into cement.

This is the second installment of Mr. Meder's article on cement. A third one will be published in a later issue—Ed.

FAULT FORMATION AT FRIANT

A fault formation uncovered in the south bank rock at Friant Dam site has resulted in a change of plans which calls for an additional 30 feet of excavation in the south river bank, just above the river diversion flume. Since erection of the concrete placing trestle depends upon the bedrock depth, this change may delay construction of the trestle to some extent.

Progress in Research as Applied to Maintenance of Bituminous Surfacing

By F. N. HVEEM, Senior Physical Testing Engineer, Materials and Research Department

Research: Studious inquiry; usually critical and exhaustive investigation having for its aim the revision of accepted conclusions, in light of newly discovered facts.—Webster's Dictionary.

IN THE following discussion, research work is not necessarily limited to laboratory investigations.

A study of the relation between research and maintenance of bituminous surfaces may at first lead to the conclusion that, strictly speaking, organized research is not often aimed directly at solving the problems of the maintenance man. The maintenance man is usually a much harassed and busy individual, confronted with unlimited problems which loudly demand time and money for their solution. With a chronic shortage of funds and an endless task to perform, it is not surprising if he seems to have little time for theoretical considerations. Hence, for the most part, maintenance methods and operations are the result of experience gained through trial and error.

However, a broader consideration of the purpose of research indicates that, in the end, almost the sole purpose in seeking improvements is to reduce the cost of maintenance. Research is, of course, only a search for more satisfactory results, and the term "satisfactory" implies, for a pavement, durability and minimum maintenance expense.

Therefore, the researcher may be only a nuisance to the construction man, as innovations and changes in procedure are often troublesome and expensive. The only justification for any added expense must lie in a commensurate reduction in maintenance cost. This does not imply substitution of a more expensive type of pavement, only that improving the quality of a particular type might at times involve some additional expense. It is realized, of course, that really effective research should reduce

both construction and maintenance cost, and make everybody happy.

Therefore, a discussion of the effect of research on maintenance can rightfully include all research related to the construction of highways. Discussing the progress under separate headings, the first consideration is

(1) Subgrade Difficulties. The need for adequate foundations has been emphasized by so many writers that one only states the obvious in stressing the need for good subgrades. While engineering opinion may differ widely on many subjects, there is no argument on this point.

The obvious need for roadbed drainage has brought about the construction of side ditches, which, while frequently effective, are very expensive in heavy cuts, and usually represent a traffic hazard. Research has shown, furthermore, that ground water does not always obligingly flow down hill, and therefore drainage by gravitational flow is not always possible.

The impossibility of draining out capillary water has led to another line of attack; namely, the stabilizing of adverse soils so that they will not be readily affected by water. The term "soil stabilization" has become about as all-inclusive and generally vague as the term "good engineering practice." That term has been cast as a sort of mantle of respectability over many a doubtful practice.

In its simplest form, "soil stabilization" is a judicious combination of existing natural soil, sand, gravel, or stone.

Another angle, largely investigated and developed by organizations seeking outlets for commercial products, involves the addition of artificial ingredients such as road oils, emulsions, portland cement, sodium and calcium salts. The intent in each case is to preserve some desirable state of equilibrium. Bituminous materials and portland cement are added to provide a water-resistant mixture that will

not soften or lose supporting power from water action. The use of the various hygroscopic salts is based on the observation that many soils have satisfactory stability with a certain optimum moisture content.

Lack of support undoubtedly causes more road surface failures than any other one cause. Lack of support is usually due to two factors: first, the existence of a soil which is readily lubricated by water; second, the presence of moisture to provide the lubrication. Water may enter the subgrade either by capillarity or by penetration of a porous wearing surface.

The placing of seal coats to prevent the entrance of rain and snow water may at times defeat its ultimate purpose, as many older roadbeds of local material or water-bound gravel have reached a satisfactory equilibrium in which the moisture rising from the subsoil is dissipated by evaporation at a rate which prevents undue accumulation. If this evaporation is stopped by a tight seal coat, moisture may accumulate beyond the capacity of the soil, and an unstable subgrade or bituminous mixture may result. It should be realized that water in the vapor state is of much greater penetrating capacity than the liquid. Laboratory experiments have been made in which dense graded bituminous mixtures were placed in saturated sand, one specimen being covered with a seal coat and one left untreated. After one month's exposure in the open air, the specimens were tested for stability. In every case, the briquettes covered by a seal coat were less stable than those without seal. Furthermore, even though the sealed specimens had all suffered a loss in stability, they did not contain moisture greatly in excess of the unsealed specimens.

The existence of a reservoir of entrapped moisture beneath pavement slabs is evidenced by the profusion of plants on either side of the high-

ways in some of the arid regions. This fact leads to the speculation as to whether plants might not be utilized as wicks to draw the moisture from subgrades. It seems to be a problem for the agricultural expert or arboriculturist.

Resilient subgrades also produce pavement distress, and this condition is not so readily detected. Such soils will often show no definite breaking or rupture of the surface; nevertheless, continued bending and flexing of the pavement slab may develop surface waves or ripples in bituminous pavements which would be entirely satisfactory over a rigid foundation.

(2) Base Course Faults. The chief cause of trouble in base courses is undoubtedly lack of thickness. Lack of funds has made many engineers tend to reduce or limit depths of base construction; while there may have been few cases that could be classed as over-design, there are many more cases where the base course is inadequate.

Another source of base failures is the use of clean rock over mud subgrades, which has often resulted in a complete lubrication of the base material; it is believed, however, that this error is not made so often of late years.

It is, of course, true that test methods and specifications originally established from research work can become outmoded with changed conditions, and may ultimately constitute liabilities rather than assets. For example, fifteen or twenty years ago, water-bound gravel or crushed stone construction was widely used, and designed to carry traffic without further treatment. It was, of course, essential for horse-drawn traffic that gravel roads be bound up tightly; hence materials needed cementing value. The need for high cementing value is no longer important, and in many cases the requirement can be dispensed with entirely. Failures in certain gravel or crushed stone bases can be charged to the attempt to meet the cementing value requirement. There is danger in the use of clay types of binder which may lubricate the stone when moisture contents are high.

(3) Aggregates Best Adapted. Since the early beginnings of bituminous construction, ideas about mineral aggregates have undergone some change. It is no longer considered

sufficient or even essential to specify that an aggregate shall be hard, sound, durable, and well graded. While it is true that durability is required, it is realized that durability and hardness are not necessarily synonymous, and the term "well-graded" is rather indefinite. The open-graded and macadam types of construction require comparatively hard aggregate, but this requirement is of little importance in a dense-graded type of construction.

An important contribution of research toward reducing the problems of maintenance has been demonstration of the fact that mineral aggregates have widely varying surface characteristics which affect their capacity to retain an oil film in the presence of water, and which may affect the stability of the mixture. In the early days of bituminous construction, many of the failures were regarded as mysterious, and were the subject of much controversial discussion. It was customary to applaud the fortunate engineer who chanced to be in charge of work which turned out well, and to greatly criticize less fortunate individuals who were trying to construct oil roads with materials which, in the light of present knowledge, were definitely unsuited for the purpose.

The researcher has uncovered a great many facts about mineral aggregates which were unknown ten years ago, one result being to place the blame for certain failures where it belongs; not on the head of the hapless engineer or superintendent in charge, but on the type of mineral aggregate used. Many aggregates are definitely unsuitable for bituminous construction due to their tendency to lose asphalt in the presence of water. These aggregates are classed as hydrophilic, and should not be used without protective measures.

Researchers throughout the world are now busily engaged seeking more effective or more economical means for treating such aggregates and oils. Progress is being made, but a great deal of work remains to be done. In the meantime, most laboratories are trying to avoid unsatisfactory materials by accepting or rejecting the aggregates and soils on the basis of preferential wetting, swell, or stripping tests. These measures have undoubtedly resulted in tremendous savings in maintenance costs. Most states can cite experience with hy-

drophilic aggregates, and their use has invariably led to continuous maintenance expense.

In fact, it is not impossible that bituminous construction with lighter oils would have been discredited completely if this phenomenon had not been recognized. There is reason to believe that the use of oil in road construction was delayed many years due to failures of this sort. The petrolithic method, described by Prevost Hubbard in 1908, involved the use of heavy asphaltic oil mixed with loose earth and compacted with a sheepfoot roller. While some of the projects were very satisfactory, others failed, as may now be surmised, due to the use of unsuitable soil types. Apparently the method fell into disrepute as a result of a few failures.

Any discussion of the subject of hydrophilic and hydrophobic aggregates must necessarily become much involved if the problem is to be treated with any sort of fairness or accuracy. There are few people qualified to speak with anything like authority on the subject of free surface energy, and the factors which encourage or discourage the adsorption and retention of liquid films.

There are no simple means yet available for classifying mineral aggregates in terms of suitability for bituminous construction. Aggregates may be identified according to petrographical or mineralogical classifications, but suitability for bituminous work does not parallel such groupings. Some generalizations may be made, if it is kept in mind that there are frequent exceptions. For example, reports from various states and countries show that granitic rocks may be either very good or comparatively poor. The same is true of limestone and most other types. Generally speaking, limestone, basalt, and trap rock are satisfactory, while quartz, chert, and rhyolite may well be viewed with suspicion. However, the only way to be sure is to test each individual material.

(4) Bituminous Materials. It is difficult to cite any important research applied to bituminous materials which has thus far borne definite fruit in the way of improved specifications which will guarantee bituminous materials entirely suited for the purposes of highway construction. Most of the present test procedures have been in use for many years, and

were established for reasons which are no longer important.

While there is almost universal agreement that existing standard tests throw little light on the suitability of oils and asphalts for road building purposes, nevertheless it has been found to be by no means a simple matter to devise acceptable methods which will approve all the suitable materials and reject all the poor ones. This problem is being studied and investigated in numerous ways by practically every important highway laboratory in the United States. There is every reason to hope that we are rapidly approaching a time when it will be possible to test a bituminous material on the basis of quality rather than by identification tests.

The most serious defect in bituminous materials is lack of durability, with consequent deterioration of the pavement due to cracking, ravelling, and disintegration. While the evidence is often contradictory, there is a certain amount of correlation between over-heating and cracking of the asphalt in the refinery, and failure due to hardening and brittleness on the road. Tests such as the Oliensis spot test, solubility in petroleum ether, and many others, have been proposed or adopted to eliminate the less durable asphalts. It is so far true, however, that asphalts which react adversely under these tests have in many cases a record of good service performance.

The problem is being approached from other angles. For example, Mr. Benson, of Kansas, has exposed thin, translucent films of asphalt to various accelerated weathering conditions, and observed changes in the character of the film under high magnification. Benson's studies suggest that asphalts in the pavement may undergo an alteration of structure described as coagulation, which materially impairs the binding value. This alteration may be reversible, so that upon extracting from the pavement, or remelting, the asphalt may revert to its original structure and the alteration no longer be evident.

One fact which adds interest to the problem is that many bituminous pavements built twenty to twenty-five years ago are still giving good service with no cracking or failures, while many recent jobs are in considerable distress. This trouble is fairly wide-

In Memoriam Robert J. Eggert

Robert J. Eggert died at his home in Sacramento, April 5, 1940, at the age of 58. Surviving are his widow, Mrs. Edith Eggert, and three sons. He was a native of Archbald, Pennsylvania, and received his education in the public schools of that State.

In 1900, he started active work, being employed at various classifications and with several different concerns, until 1921, when he took an engineering position with the Division of Highways, becoming chiefly engaged in drafting work in District III. In 1927 he transferred to District X as an engineering draftsman, at which work he was engaged until death.

In his work, Mr. Eggert was a hard-working, conscientious employee, and a faithful public servant. He was a loyal friend, being well liked by his fellow workers and associates.

Midstate Chapter and District X of the Division of Highways feel the loss of its member and employee, and do hereby express to his widow and loved ones our deepest sympathy for their great loss.

spread, and has been reported by many states.

At the present time, asphalt technologists are in agreement that, for best results, bituminous pavements should be made using as soft an asphalt as possible, using as much asphalt as possible without loss of stability, and making as dense a mixture as possible. In past years, a large proportion of bituminous pavements became rough and wavy sooner or later because of unstable mixtures, usually due to an excess of asphalt. Stability tests were introduced as a check on this condition. It should be emphasized, however, that in attempting to obtain high stability, other properties may be sacrificed and mixtures produced that are too dry and brittle to withstand the effects of weather and traffic.

The relative merits of the numerous grades of slow, medium, and rapid curing products is a subject which could lead to considerable discussion. There appears to be no point in strongly advocating the virtue of this or that type of material over another, inasmuch as satisfactory roads have been built with most all of the available products. It may be remarked, however, that the best ma-

terial to use is the cheapest one which will serve the particular purpose, and when this consideration is put to the test, it is surprising how few cases are definitely unsuitable for the various slow curing oils, although it must be emphasized that the various cutbacks and emulsions very definitely have their place.

(5) **Special Problems.** One of the few special problems related to maintenance which has been the subject of some investigation concerns the design of premix materials for use in maintenance patching. In California, a great deal of the patching of existing pavements is made by means of dense graded premixed material stored in stockpiles. At intervals, certain shipments of this premixed material have been found to be unsatisfactory, either failing to set up, to bond to the old surface, or to remain stable under traffic. It appears that a patching material must have a rather nice balance of properties. It must be neither too fine nor too coarse, the oil can be neither too heavy nor too light, and the permissible aggregate gradation must evidently be kept within narrower limits than is essential for new construction.

For this reason, studies have been made in California attempting to analyze various stockpiled mixtures which have been found to be both satisfactory and unsatisfactory. While the work is by no means complete, and further evidence is desirable before making too positive statements, nevertheless the following grading tolerances are suggested which, with the average types of mineral aggregate, should furnish satisfactory mixtures for maintenance patching. The following tabulation gives the proposed gradation in terms of the U. S. Standard Sieve Series A.S.T.M. designation E-11-26, A.A.S.H.O. 1927:

	3-Inch	2-Inch	1-Inch	4-Mesh
	%	%	%	%
1-Inch -----	100			
3-Inch -----	95-100	100		
2-Inch -----		95-100	100	
1-Inch -----	65- 85	80- 95	95-100	100
4-Mesh -----	50- 65	58- 73	65- 85	95-100
16-Mesh -----	30- 43	33- 45	38- 52	46- 67
50-Mesh -----	18- 27	18- 27	22- 30	25- 36
200-Mesh -----	6- 10	6- 12	8- 15	10- 17
Oil Ratio*	3.9-4.6	3.9-4.7	4.2-5.0	4.5-5.3

*For average types of aggregates.

The most satisfactory grades of liquid asphalt for premix patching material have been SC-4, ROMC-3, and MC-2, with the predominating preference in the order stated.

State of California

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Department of Public Works

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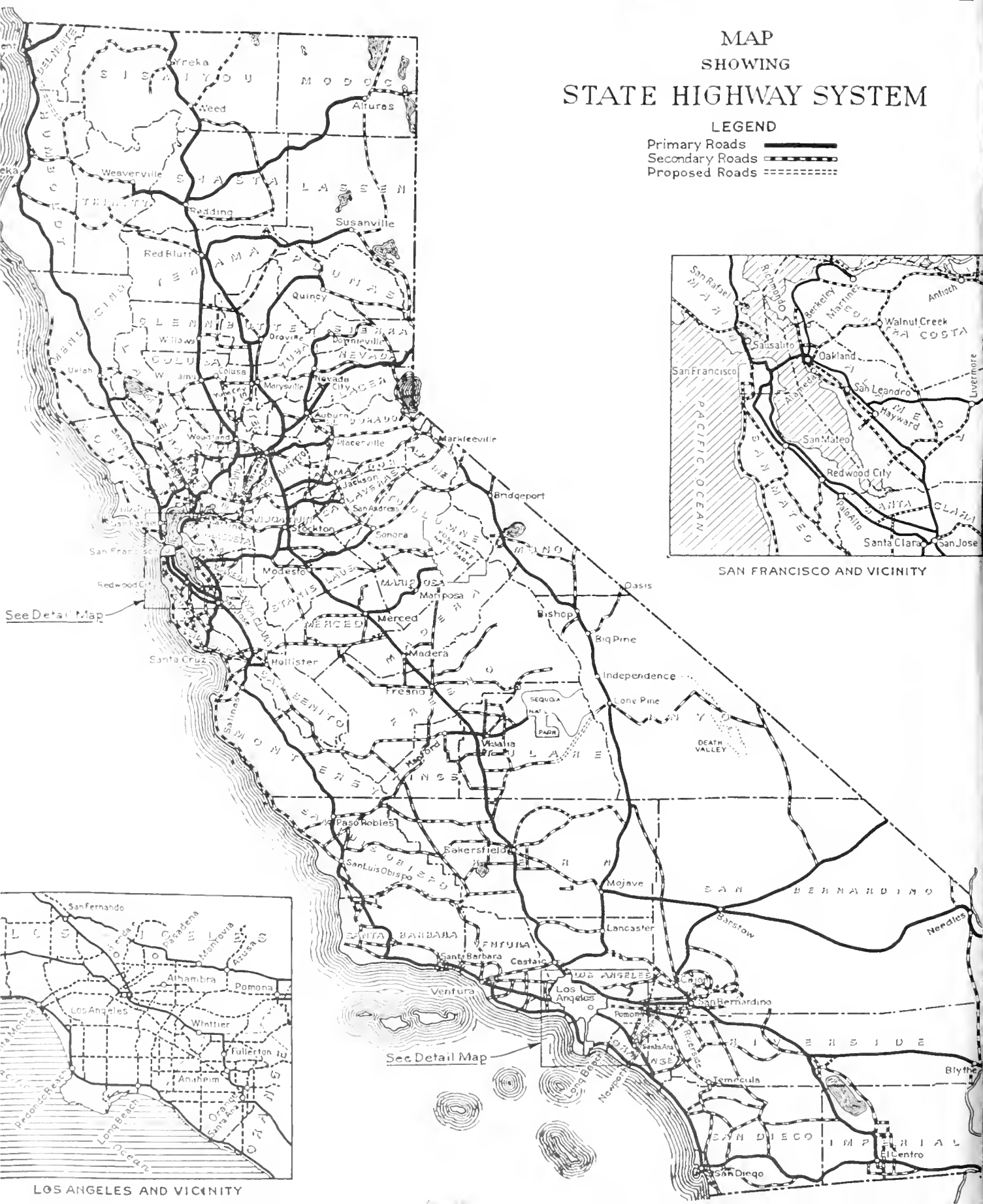
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SHOWING
STATE HIGHWAY SYSTEM

LEGEND

Primary Roads —————
Secondary Roads - - - - -
Proposed Roads = = = = =





CALIFORNIA

HIGHWAYS AND PUBLIC WORKS

AERIAL VIEW OF TREASURE ISLAND. SHOWING PARKING AREA; BAY BRIDGE
WITH STATE BUILT RAMP CONNECTION AND BATTLESHIPS
IN BACKGROUND. (SEE ARTICLE IN THIS ISSUE)

JUNE
1940

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California

FRANK W. CLARK, Director

C. H. PURCELL, State Highway Engineer

J. W. HOWE, Editor

K. C. ADAMS, Associate Editor

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State Negotiating to Buy the Carquinez and Antioch Toll Spans Both on State Highways

By FRANK W. CLARK, Director of Public Works

PREDICATING its action upon an act passed by the Legislature in 1937, the California Toll Bridge Authority in conformity with the wishes of Governor Culbert L. Olson, its chairman, has submitted to the American Toll Bridge Company an offer to purchase the Carquinez and Antioch bridges.

The Board of Directors of the company has voted to accept the proposal and will submit it to its stockholders for approval. Negotiations for State ownership and operation of the two spans are proceeding as rapidly as is consistent with proper safeguarding of public interests involved in the deal.

While the State's offer has been approved by the directors of the Toll Bridge Company and awaits action by the stockholders, all phases of the proposed purchase will be given thorough consideration by the Department of Public Works and all problems connected therewith adjusted before any deal is consummated.

Final steps in the present negotiations will be subject to approval by the Toll Bridge Authority.

Shortly after taking office, Governor Olson took up with me the matter of the acquisition by the State of the Carquinez and Antioch bridges. The Governor was prompted by widespread dissatisfaction over the high tolls charged motorists for use of the Carquinez span and his firm conviction that toll bridges on State highways should be eliminated.

PROPOSITION SUBMITTED

On May 9, I submitted to the California Toll Bridge Authority a proposal that the State issue, under the California Toll Bridge Authority Act, revenue bonds in the sum of \$6,850,000 for purchase of the American Toll Bridge Company's properties, including the Martinez-Benicia Ferry which



FRANK W. CLARK

operates across Suisun Bay. This amount of money would provide sufficient funds to buy the bridges, cover acquisition costs, and give the Authority a cash reserve of \$350,000.

At that time I expressed the belief that the present automobile toll on the Carquinez and Antioch bridges of 45 cents per car, 5 cents for the driver and 5 cents for each additional passenger could be reduced under State ownership to a flat rate of 25 cents per car, the same toll to apply to commercial vehicles of not more than 3000 pounds weight. I also estimated that under State operation of the structures the motoring public using the bridges would benefit between now and the expiration in 1948 of the span franchises held by the American Toll Bridge Company to the extent of ap-

proximately \$4,000,000 through lowered tolls.

PROPOSAL APPROVED

The Toll Bridge Authority unanimously approved my proposal and a formal offer to purchase was submitted to the American Toll Bridge Company, the directors of which, on May 21, voted to accept the State's offer.

In presenting my proposal to the Authority, I cited section 1 of the California Toll Bridge Authority Act, which declares it to be the policy of the State of California to acquire and own all the toll bridges situated upon or along any part of the highways of the State with the end in view of ultimately eliminating all toll charges thereon.

I also called attention to the fact that the California Toll Bridge Authority and the State Department of Public Works were authorized by an act of the Legislature in 1937 to acquire by purchase or by eminent domain the Carquinez and Antioch bridges.

NO PROGRESS MADE

Since enactment of the California Toll Bridge Authority Act of 1929, no definite progress has been made by responsible State agencies to make effective, in so far as the Carquinez and Antioch bridges are concerned, the policy of the State of California with respect to toll bridges or to take advantage of the enabling provisions of the Act of 1937, empowering the Authority and the Department of Public Works to acquire the Carquinez and Antioch bridges.

To enable the State to acquire the Carquinez and Antioch spans, I proposed to the Authority the issuance of one- to fifteen-year serial bonds with all maturities beyond the seventh year of maturity being subject to call and redemption at any time. I am



Privately owned Carquinez Toll Bridge across the Straits of Carquinez on State Highway Route 7, U. S. 40.

convinced that the cost of the bridges will be amortized and paid and the structures made toll-free highways within approximately the same period of time as would be the case under the existing franchises held by the American Toll Bridge Company.

IN THE PUBLIC INTEREST

It is my considered judgment that public interest and necessity require the immediate purchase of these bridges by the State. Following the action of the Toll Bridge Authority in directing me to enter into negotiations with the American Toll Bridge Company, two questions having to do with State ownership of the bridges and which required investigation were raised. On May 21, officials of Contra Costa, Solano and Sacramento counties, meeting with me in Sacramento, requested an opinion as to whether the State, in the event it purchased the bridges, would continue to pay to the three counties until 1948 the taxes they now receive annually from the American Toll Bridge Company un-

der their franchise rights.

The proposal to acquire the properties of the American Toll Bridge Company contemplates the setting aside of \$44,000 a year from bridge revenues for payment of taxes to the three counties involved for the remaining life of the franchises, provided the State is legally bound to pay these taxes.

QUESTION OF PROPERTY RIGHT

It is the view of the Legal Division of the Department of Public Works that the property right of the American Toll Bridge Company in the Carquinez Bridge is not ownership of the physical structure, i.e., the bridge, itself, but rather the right to take tolls for the remaining period of the franchise, that is, until March 7, 1948.

I have asked Attorney General Earl Warren for a ruling on the question of whether the State will, in the event it buys the Carquinez and Antioch bridges, be legally obligated to continue tax payments to Contra Costa, Solano and Sacramento counties.

On May 26, I met in Martinez with officials of that city and of Benicia and Contra Costa and Solano counties to discuss the question of the future of the Martinez-Benicia Ferry following State purchase of the American Toll Bridge Company properties.

WANT FERRY CONTINUED

Citizens and civic groups of Martinez, Crockett, Benicia, Vallejo, and of Contra Costa and Solano counties had requested assurances from Governor Olson, the Toll Bridge Authority and myself that the ferry service would not be abandoned if the State acquired the bridges and the ferry.

In order to determine what action the State should take with respect to the Martinez-Benicia ferry, I directed the Division of Highways to institute on May 28 a traffic count on the Martinez-Benicia Ferry to ascertain the origin, destination and amount of traffic using the ferry. This count was made over a seven-day period. Our analysis of the survey will assist us in determining whether continu-

ance of the ferry service is necessary in the public interest and whether such continuance would seriously affect anticipated revenues of the Carquinez Bridge.

The Carquinez Bridge crosses the straits of Carquinez between Crockett and Vallejo and is a link in the State Highway System, being an integral part of U. S. 40, State Route 7. It is a section of the main highway route which connects the East Bay District with highways leading to the Napa and Sacramento valleys and the Redwood Empire. It is a steel cantilever structure consisting of two 1100-foot cantilever spans, two 500-foot anchor spans, a 150-foot tower span, and 1132 lineal feet of viaduct at its southerly end, making a total bridge length of 4482 feet.

ON ALTERNATE ROUTE

The Antioch Bridge crosses the San Joaquin River about four miles east of Antioch on State Route 11, which runs along the Sacramento River providing an alternate route to the East Bay. It consists of one 320-foot steel lift span and one 320-foot fixed span, 2078 lineal feet of steel deck truss span on towers and 1921 lineal feet of reinforced concrete pile trestle, making a total bridge length of 4639 feet.

The Martinez-Benicia Ferry Co.,

whose stock is owned by the American Toll Bridge Company, operates ferries across Suisun Bay connecting county highways in Solano and Contra Costa counties and affording an alternate route between the Bay district and the Sacramento Valley. It competes to some extent with the Carquinez and Antioch bridges.

On February 5, 1923, the board of supervisors of Contra Costa County granted a 25-year franchise to construct and operate the Carquinez Bridge. Construction work was started in April, 1923, and the bridge was opened to traffic on May 21, 1927.

FRANCHISE GRANTED

On June 4, 1923, a 25-year franchise was granted by Contra Costa County to construct and operate the Antioch Bridge and this span was opened to traffic on January 1, 1926.

The franchise granted to the American Toll Bridge Company for the Carquinez Bridge will expire on March 7, 1948, at which time the structure, if not acquired by the State, shall become the property of Contra Costa and Solano counties and, because it is on a State highway route, presumably would become a free bridge and a part of the State Highway System.

Under an act passed by the 1937

Legislature, toll bridges were designated as public utilities. This act became effective on August 27, 1937, and under it the State Railroad Commission acquired jurisdiction to fix rates of toll bridges such as the Carquinez Bridge.

COMMISSION INVESTIGATION

Immediately after the effective date of this law, the Railroad Commission instigated, on its own motion, an investigation of the tolls being charged on the Carquinez Bridge. The taking of testimony covered a period of several months, during which the entire history of the bridge, particularly the financing thereof, the returns from tolls and probable future earnings, were gone into exhaustively by the Commission.

The Commission made its decision on February 6, 1938, by which it reduced the charge on the Carquinez span per vehicle from sixty cents to forty-five cents and reduced the charge per passenger from ten cents to five cents. The validity of the Commission's action was attacked by the American Toll Bridge Company in a proceeding before the Supreme Court of California. This tribunal upheld the ruling of the Commission.

The Supreme Court of the United States granted a review of the deci-



Privately owned Antioch Toll Bridge across the San Joaquin River on State Highway Route 11 near Antioch, Contra Costa County.

sion of the State court. But again the validity of the legislation placing the bridge under the regulation of the Commission as a public utility and of the order of the Commission reducing tolls was upheld in a decision rendered June 5, 1939.

The statement I made to the California Toll Bridge Authority is as follows:

May 8, 1940

California Toll Bridge Authority
Sacramento
California

Gentlemen:

Section 1 of the California Toll Bridge Authority Act reads: "It is hereby declared to be the policy of the State of California to acquire and own all toll bridges situated upon or along any part of the highways of the State, with the end in view of ultimately eliminating all toll charges thereon."

SECTION 1 OF CHAPTER 927, STATUTES OF 1937, READS: "THE CALIFORNIA TOLL BRIDGE AUTHORITY AND THE STATE DEPARTMENT OF PUBLIC WORKS ARE HEREBY AUTHORIZED AND EMPOWERED TO ACQUIRE BY PURCHASE OR BY EMINENT DOMAIN THAT CERTAIN PRIVATELY OWNED TOLL BRIDGE KNOWN AS CARQUINEZ BRIDGE, NEAR CROCKETT, CALIFORNIA, AND THAT CERTAIN PRIVATELY OWNED TOLL BRIDGE ACROSS THE SAN JOAQUIN RIVER CONNECTING THE COUNTIES OF SACRAMENTO AND CONTRA COSTA, COMMONLY KNOWN AS THE ANTIOCH BRIDGE, OR EITHER OF THEM."

The California Toll Bridge Authority Act was passed by the Legislature in 1929. The act authorizing acquisition by the State of the Carquinez and Antioch bridges was passed by the Legislature in 1937.

Since 1929 no definite progress has been made by responsible State agencies to make effective in so far as the Carquinez and Antioch bridges are concerned the policy of the State of California with respect to toll bridges or to take advantage of the enabling provisions of the Act of 1937 empowering this Authority and the State Department of Public Works to acquire the Carquinez and Antioch bridges.

It is, therefore, with a deep sense of personal satisfaction that, in line with the wishes of Governor Culbert L. Olson, I submit to you herewith a recommendation that in accordance with procedure provided by law the Department of Public Works be authorized to institute the necessary legal proceedings to acquire from the American Toll Bridge Company for State ownership and operation both the Carquinez Bridge and the Antioch Bridge, which are privately owned and operated as toll bridges on State highways.

The record shows that for many years there has been a continuing public demand and sporadic legislative agitation for the State of California to relieve the

motoring public of the high tolls which have been charged for the use of these two waterway spans.

The files of the State contain innumerable reports of investigations, surveys and studies with respect to these two American Toll Bridge Company properties (the Carquinez Bridge in particular) made by State employees upon order of the Legislature and executive officials in previous administrations, but I find no record of any definite or serious negotiations having been undertaken to eliminate the financial barriers to public travel on State Highway Route No. 7 as represented by the Carquinez Bridge and on State Highway Route No. 11 as represented by the Antioch Bridge. The Carquinez Bridge especially is an important link of the State Highway System, carrying a large volume of motor vehicle traffic from the Sacramento Valley to the Bay District.

Private toll bridges do not properly fit into our present State Highway System. Conceding that these toll bridges were constructed under old statutory authority, and allowing for factors existing at the time of their construction but which now are non-existent, it is clear that the demands of a modern State Highway System require their prompt elimination.

THE PRESENT ADMINISTRATION OF THE STATE OF CALIFORNIA IS VITALLY INTERESTED IN FURNISHING HIGHWAY FACILITIES FOR PUBLIC USE AT THE MINIMUM OF PERSONAL INCONVENIENCE AND EXPENSE. I NEED ONLY CITE THE EFFORTS OF GOVERNOR OLSON AND MEMBERS OF THIS CALIFORNIA TOLL BRIDGE AUTHORITY IN REDUCING TOLLS ON THE SAN FRANCISCO-OAKLAND BAY BRIDGE, FIRST FROM FIFTY CENTS TO FORTY CENTS PER PASSENGER CAR, THEN FROM FORTY CENTS TO THIRTY-FIVE CENTS, AND NOW FROM THIRTY-FIVE CENTS TO THIRTY CENTS, AS STRIKING EVIDENCE OF WHAT CAN BE ACCOMPLISHED BY PUBLIC OFFICIALS WORKING IN THE PUBLIC INTEREST. IN SHARP CONTRAST IS THE RECORD OF PRIVATELY OWNED AND OPERATED TOLL BRIDGES, THE TOLL CHARGES ON WHICH HAVE BEEN PROVOCATIVE OF WIDE DISSATISFACTION.

IT IS IN KEEPING WITH GOVERNOR OLSON'S POLICY OF FURTHERING PUBLIC OWNERSHIP THAT HIS ADMINISTRATION SHOULD, AFTER YEARS OF PROCRASTINATION IN THIS MATTER, OFFICIALLY INITIATE ACTION TO ACQUIRE THE CARQUINEZ AND ANTIOCH BRIDGES IN THE NAME OF THE CALIFORNIA TOLL BRIDGE AUTHORITY FOR THE PEOPLE OF THE STATE OF CALIFORNIA.

Preliminary and informal exchanges of ideas between the American Toll Bridge Company and the Department of Public Works have resulted in a tentative agreement as to the best method of establishing a monetary value on these bridges that will be most compatible with the greatest

public benefit and without unnecessary injury to any private investor.

The present toll charges on the Carquinez and Antioch bridges are 45 cents per car plus 5 cents for the driver and 5 cents for each passenger, or an average rate of over 55 cents for each car.

ACQUISITION OF THE CARQUINEZ AND ANTIOCH BRIDGES BY THE STATE ON THE BASIS PROPOSED IN THE ACCOMPANYING REPORT OF THE DEPARTMENT OF PUBLIC WORKS WILL IMMEDIATELY PERMIT OF THE REDUCTION OF AUTOMOBILE TOLLS TO 25 CENTS PER CAR INCLUDING FIVE PASSENGERS. THIS RATE WILL APPLY TO COMMERCIAL VEHICLES UNDER THREE THOUSAND POUNDS WEIGHT. THEREFORE, WHAT WE PROPOSE IS A REDUCTION OF OVER 50 PER CENT IN TOLLS ON THE CARQUINEZ AND ANTIOCH BRIDGES; I.E., FROM A PRESENT AVERAGE OF OVER 55 CENTS PER CAR TO 25 CENTS PER CAR.

THE PRIVATE TOLL COLLECTING FRANCHISES HELD BY THE CARQUINEZ AND ANTIOCH BRIDGES EXPIRE ON MARCH 4 AND JULY 4, 1948, RESPECTIVELY.

IT IS ESTIMATED THAT UNDER STATE OWNERSHIP OF THESE STRUCTURES, THE MOTORING PUBLIC USING THE BRIDGES WILL BENEFIT BETWEEN NOW AND THE EXPIRATION OF THE FRANCHISES TO THE EXTENT OF APPROXIMATELY \$4,000,000 IN SAVINGS ON BRIDGE TOLLS.

It is further estimated that the cost of the bridges will be amortized and paid and the structures made toll-free highways within approximately the same period of time as would be the case under the existing franchises held by the American Toll Bridge Company.

This is a most conservative estimate as it is based upon actual 1939 traffic and reflects the difference between the present automobile toll and the proposed rate of 25 cents. It makes no allowance for any increased traffic resulting from the substantial toll cut. On the basis of the actual traffic experience of the last six months, a saving to the motoring public of some \$4,000,000 will be effected in the approximate nine-year period required to make the bridges toll-free.

The indicated savings are arrived at after including the cost of paying off the revenue bonds issued to acquire the bridges, including all interest, as well as all other costs.

A one- to fifteen-year serial bond issue with all maturities beyond the seventh year of maturity being subject to call and redemption at any time, is proposed as the best method to acquire these bridges. One important reason for a one- to fifteen-year callable serial bond issue is that it will enable the Toll Bridge Authority in the future either to order a further reduction of tolls or make more rapid payment of bonds by calls ahead of maturity. However, based upon my study and knowledge of the situation, it is my recommendation that any future reductions

of tolls be confined to those made possible by reason of increased traffic over the bridges and additional revenues resulting therefrom. This, of course, would justify lower tolls and at the same time result in a toll-free bridge at no further extended date.

IT IS MY OPINION THAT THE ISSUANCE AND SALE BY THE CALIFORNIA TOLL BRIDGE AUTHORITY OF \$6,850,000 PAR VALUE OF REVENUE BONDS WILL PROVIDE SUFFICIENT FUNDS TO PURCHASE THE BRIDGES AT A COST OF \$6,480,000, TO COVER CERTAIN INCIDENTAL ACQUISITION COSTS AND TO PROVIDE A CASH RESERVE FUND OF \$350,000.

As is indicated by Exhibit C attached to and made a part of the Determination Order of the Department of Public Works relating to the Carquinez Bridge and the Antioch Bridge, the expected future traffic over these structures will provide ample revenues for all revenue bond service charges (interest and amortization of said bonds) within a period conservatively estimated at nine years.

Based upon actual 1939 traffic and after allowing for all operating expenses (including an allowance for 2 per cent gross earnings tax, franchise tax and personal property tax) the net earnings under public ownership by the State will permit—

(a) The financing of acquisition costs by the issuance of revenue bonds payable solely from earnings;

(b) The retirement of the revenue bonds, principal and interest in full in a period of time closely comparable to the remainder of time the present franchises exist to collect private tolls;

(c) The application of additional income resulting from the increase in traffic due to the further lowering of toll charges or to the more rapid retirement of the bond issue.

It is entirely proper for me to state that in addition to personally reviewing the work of our own experts, I have secured the advice and opinion of independent investment bankers by whom I am assured that the California Toll Bridge Authority will be able to finance the cost of the acquisition of the Carquinez Bridge and the Antioch Bridge by the issuance of revenue bonds bearing interest at not more than 3 per cent and that the cost to the State of these structures can be paid entirely from toll revenues.

I am convinced that the sum of \$6,480,000 would be a fair price to the stockholders of the American Toll Bridge Company and a fair and advantageous price to the State.

Adding to this sum approximately \$20,000 for expenses incidental to acquisition and financing, together with a reserve

fund of \$350,000, it would require, I repeat, a bond issue of \$6,850,000 to entirely consummate the proposed purchase.

The \$350,000 reserve fund is not to be regarded as an increase in the purchase price, as the California Toll Bridge Authority will retain this amount in cash.

I respectfully suggest that you authorize me, as Director of the Department of Public Works, to offer this price for the bridge properties of the American Toll Bridge Company which offer. I have reason to believe, if made at this time, will be acceptable.

I submit this report and recommendation to you with a feeling of personal satisfaction. I am proud to have been a party to the creation and development of this opportunity for public service to the people. With Governor Olson, I have every reason to believe that acquisition by the State of California of the Carquinez Bridge and the Antioch Bridge can be consummated if steps to that end are promptly taken by the California Toll Bridge Authority.

It is my considered judgment that public interest and necessity require the immediate purchase of these bridges by the State and as Director of the Department of Public Works I so recommend to you.

Respectfully yours,

FRANK W. CLARK,
Director of Public Works.

Bridge Company Accepts State Offer to Buy Spans

Director of Public Works Frank W. Clark received the following letter from the American Toll Bridge Company under date of May 21, 1940, accepting his proposal for State purchase of the Carquinez and Antioch bridges:

"The American Toll Bridge Company has received your offer dated May 9, 1940, to purchase the Carquinez and Antioch Toll Bridges and certain related assets, for a price of \$6,480,000, which you advise is subject to the ability to finance the bonds to be issued and the final approval of the offer by the California Toll Bridge Authority.

"It has always been the policy of this Company to cooperate with any program directed toward public ownership of these toll bridges which will result in lower tolls to the traveling public. The Company's opportunity to recoup its capital investment being limited by the expiration of its franchises in 1948, prevented voluntary reduction of tolls on its part. Under the circumstances as they now exist your offer of \$6,480,000 is acceptable to the Board of Directors of this Company and the Board will recommend to the stockholders of this Company that they approve that price.

"The Company, upon approval of its stockholders, stands ready to convey to you all of its title and interest to the bridges and the related assets covered by your offer. The Company believes that it can convey to the State full and complete rights and titles necessary to public ownership; however, the terms and conditions necessary to consummate the transaction must be worked out in accordance with the facts.

"This communication is to advise you that the offer is accepted by the Board of Directors of this Company subject to agreement on terms and conditions. The Company will be glad to meet with you at your convenience with a view to consummating the transaction at the earliest practical date.

"Very truly yours,

"AMERICAN TOLL-BRIDGE COMPANY

"By Wm. F. Morrish, President."



State Highway relocation on U. S. 101 between Bass Hill and O'Brien Summit involves record grading in Northern California.

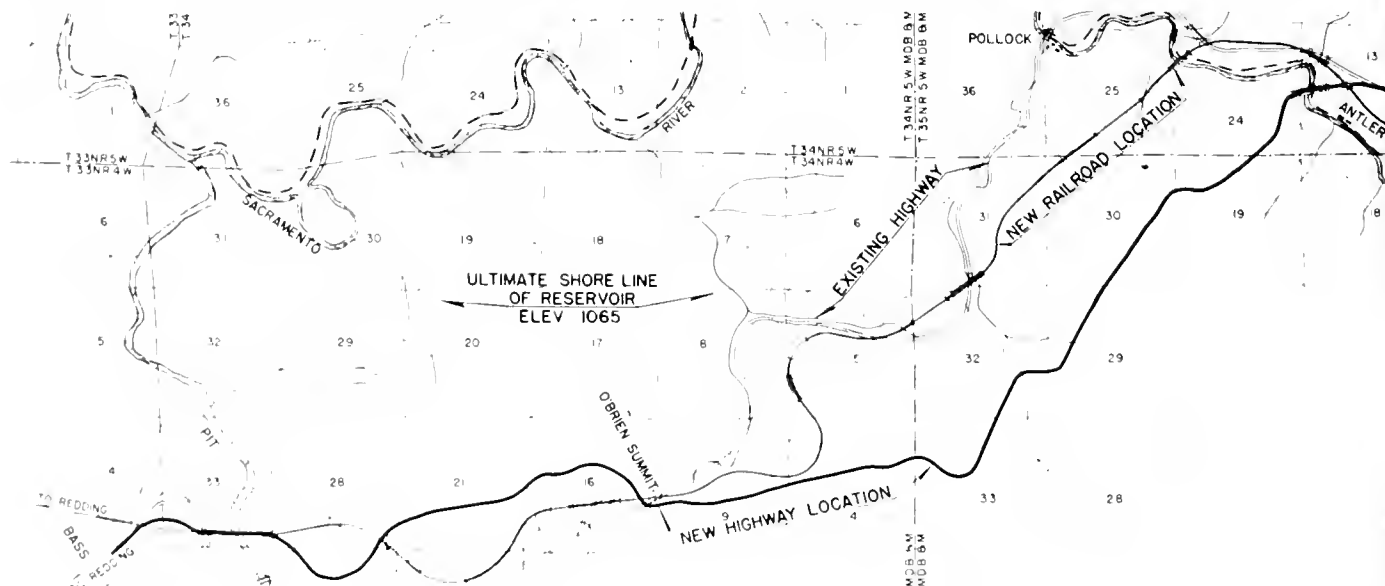
Relocation North of Shasta Dam

By F. W. HASELWOOD, District Engineer

THE CONSTRUCTION of the Shasta Dam Unit of the Central Valley Project and the consequent flooding of the canons of the Sacramento, Pit and McCloud

rivers, will eliminate from use, 18.1 miles of the Pacific Highway. To replace this, 15.5 miles of highway must be constructed on a new location.

The work will be accomplished by seven contracts, of which one has been completed, five are in progress and the seventh will be awarded in 1941.



The reconstruction of the highway is essentially a part of the Central Valley Project, which is being financed and constructed by the U. S. Government, under the supervision of the Bureau of Reclamation. In order to secure certain improvements in standards on the relocated highway, the State is contributing to the cost. The State's share of the cost, as measured by the value of the improvement in standards being secured, approximates 10 per cent of the grading and surfacing costs and 23.5 per cent of the cost of the bridge across the Sacramento River near Antler.

GRADE SEPARATION NECESSARY

The first unit to be constructed consisted of 2.53 miles at the north end of the relocation where the conflict was with the relocation of the Southern Pacific Railroad rather than with the reservoir. This work was included with an adjoining unit of railroad relocation and was awarded to Granfield, Farrar & Carlin by the Bureau of Reclamation, in the spring of 1939. Work was completed in the fall at a cost of \$157,507.

As a part of the railroad work included in this contract, a grade separation structure was built near Antler to allow the highway to pass under the railroad. This structure provides for two lanes each way, with an 8-foot dividing strip.

All other work involved in the highway reconstruction, except the Pit River bridge, which is a joint railroad and highway structure, is being supervised by the Division of Highways.

HEAVY GRADING CONTRACT

The first contract to be awarded by the State was for grading 4.08 miles between Bass Hill and O'Brien Summit. This is the southerly unit of the relocation and lies on either side of the Pit River bridge. Granfield, Farrar & Carlin were awarded this contract on November 29, 1939. The contract includes the movement of about 1,164,000 cubic yards of excavation and the construction of a concrete bridge 376 feet long on the face of a precipitous bluff over the north portal of tunnel number 3 on the relocation of the Southern Pacific Railroad.

This unit contains some of the heaviest grading ever undertaken on two-lane construction in Northern California. In one mile on this project movement of 598,000 cubic yards of excavation is required.

(Continued on page 25)



On the highway relocation north of Shasta Dam, this grading contract requires moving 598,000 cubic yards in one mile.

Santa Barbara Coast Highway Project Reduces Steep Grades

By L. E. McDOUGAL, District Office Engineer

ON DECEMBER 11, 1939, Director of Public Works Frank W. Clark awarded a contract for the grading and surfacing of that portion of the Coast Highway designated as U. S. 101 and located approximately between one-half mile east of El Capitan Creek and the Southern Pacific Siding of Orellana, being 2.3 miles in length. This section along the coast is separated from the shore line by the Southern Pacific Railroad for its entire distance.

In the design it was determined that this section of highway would eventually lend itself to a type of freeway construction, as will most of the highway in this general vicinity. As the centerline of the highway parallels the Southern Pacific Railroad limited access on the southerly or ocean side is controlled by the railroad. On the land or northerly side,

however, sufficient width of right of way was obtained to provide for an eventual four-lane construction with a median strip and service road.

LONG VERTICAL CURVES

The design selected provides for rolling the grades down into the drainage crossings, but with much lighter grades and long vertical curves to give as long a sight distance as was economically justified. The maximum gradient on the highway now under construction will be 2.23 per cent as compared with 6½ per cent on the existing highway and the minimum vertical sight distances will be 2000 feet as compared with 400 feet.

Two other methods of design were investigated before the final adoption of that being constructed. The first of these would have followed the same alignment but with only nominal im-

provement of sight distance and gradients. The second design study contemplated the construction of two new lanes separated from the present pavement by a median strip 6 feet to 26 feet wide, with only nominal correction of grade to obtain "non-passing sight distance," and correction of alignment to that of final design.

THE OLD AND NEW

Because of the nature of the reconstruction, which for a considerable distance follows closely the present center line of pavement, it was necessary to design detours covering a major portion of the job.

The roadbed section on the existing highway had a graded width averaging about 30 feet, on which had been placed at various times between 1919 and 1936 a 15-foot by 4-inch portland cement concrete base, later

Coast Highway reconstruction in Santa Barbara County showing the existing highway, the new grade and an ocean panorama.





View of new grade under construction east of El Capitan Creek while traffic uses the existing highway.

widened with 2½-foot by 6-inch portland cement concrete shoulders. Between these concrete shoulders a 15-foot by 2-inch asphaltic concrete surface was placed in 1923. The shoulders were subsequently road-mixed with asphaltic oil and a portion of them sealed.

The tabulation below will indicate the improvement being accomplished in this reconstruction project. Excellent alignment and grades will carry traffic at high speeds with safety and with a minimum of delay, even considering the anticipated increase in total traffic, particularly truck traffic:

	Present	Proposed
Number of curves (1000 feet radius or less)----	2	0
Minimum radius -----	700'	3800'
Total angles -----	78 4½'	22- 17'
Maximum grades -----	6.5%	2.23%
Minimum vertical sight distance -----	400'	2000'

BASE THICKNESS

The section being used in the going construction provides generally for a 1-foot thickness of select material placed directly on the new grade for the entire width of the roadbed which is generally about 42 feet. On this selected material subbase a variable thickness of imported borrow or

stabilized base is to be placed. This base treatment will be 6 inches thick under the roadway surfacing and a lesser thickness on the shoulders. On this stabilized base will be placed a 22-foot width of plant-mixed surfacing of 3 inches to 4 inches minimum thickness.

On the shoulders and gutter or berm there will be 1¼ inches of oil-mixed material salvaged from the detour surfacing topped by 1¾ inches of plant-mixed surfacing. This surfacing section, of course, varies throughout the job, depending upon the proximity of the existing 20-foot portland cement concrete and asphaltic concrete pavement and other factors.

On the up-hill side there will be constructed, for a considerable portion of the distance, an intercepting ditch and dike 4 feet deep and 16 feet in width. The material in the adjoining fields is very highly cultivated and is of such a friable nature that it washes readily if not in crop at the time of heavy rainfall. The result is that considerable material is carried directly onto the pavement if such an intercepting ditch is not built.

The cut slopes are generally 1½:1 as are also the fill slopes. There are a few exceptions where cut slopes have been designed on 1:1 slope and

in some of the lighter fills 4:1 slopes are used.

The stabilized 6-inch depth of base treatment referred to above is a partial misnomer in that certain sections will not be so treated; however, most of the job will have a plant-mixed base using liquid asphalt, a portion of which will use about 5 per cent ROMC 5 and the balance 3½ per cent of a stabilizing type of asphaltic emulsion. These three types of base, all with the same mineral aggregate, are being used on this section more or less as an experiment to obtain data as to the relative value of bituminous stabilized bases as compared with untreated bases.

The base material both stabilized and untreated as well as the mineral aggregate for plant-mixed surfacing will be obtained from a local deposit in the Arroyo Quemado about five miles westerly from the west end of the present project. This material has been used on other projects in this general vicinity and found to be very satisfactory for this type of construction. This material was to be used for the oil-mixed detours and later removed to form a portion of the surfacing on shoulders. However, the contractor has elected to use

(Continued on page 23)

Flood Control and Restoration Bill Passed by Legislature

TAKING cognizance of the grave emergency occasioned by the storms and floods during the spring of 1940, Governor Olson included items in his call for the second extraordinary session in 1940 to provide funds for construction work on the Sacramento River Flood Control Project and for repair and restoration of property damaged or destroyed by these storms and floods. The Legislature took action upon these matters and, with the Governor's approval, Chapters 1 and 2, Statutes of 1940, second extra session, have become law—Chapter 1 providing money for repair and restoration and Chapter 2 providing money for construction work on the flood control project.

Over 635,000 acres of land were inundated by the successive high waters in Northern California, and damage or destruction to public and private property exceeding \$12,000,000 occurred as a result thereof. Applications received for State assistance in repair of flood damaged property total in excess of \$2,500,000. Within the area of the Sacramento River Flood Control Project, most of the damage was resultant from breaks in levees and works which had not been brought up to grade and cross section contemplated in the eventual plans.

Federal money is available for furthering construction on the Sacramento project dependent upon State contributions for the same purpose. Chapter 2 appropriates \$1,900,000 for the works and will go far to aid completion of the project under the present approved plans. A Federal appropriation of \$1,242,000, for construction, is under consideration at this time by the Congress and favorable action thereon is anticipated. However, due to experience acquired during the recent floods, some revision of the project may be required, and a survey by the Federal Government is in progress to determine this matter.

The Reclamation Board is the State agency dealing with construction plans on the Sacramento River Flood Control Project, while the Depart-

British Museum Asks For Magazine

The Science Museum
South Kensington,
London, S. W. 7

Sir:

With reference to your kindness in presenting the publications of the Department of Public Works to the National Library of Science and Technology at the Science Museum, I would inquire whether you would be so good as to present also the publication "California Highways and Public Works."

In addition to its comprehensive sets of literature on cognate subjects, which are not available in special libraries, this Library contains an exceptionally extensive collection of works on highway engineering.

Ten thousand scientific and technical periodicals are received regularly in the Library. All publications added to the Library are recorded in its Weekly List of Accessions to the Library, which has a wide circulation among research workers and institutions.

I invite your attention to the enclosed leaflet, which gives an account of the scope, aim, and activities of the Library.

I am, Sir,

Your obedient servant,
E. JONES,
Director.

ment of Public Works carries out State maintenance work and such of the actual construction work as may be delegated by the Reclamation Board.

Outside of the works of the project, great damage occurred from storms and floods subsequent to January 1, 1940, in various parts of the State to levees, flood control works, irrigation

works, city and county roads and bridges and other property having a general public and State interest, for the cost of repair or restoration of which Chapter 1 appropriates \$500,000 to the State emergency fund for expenditure by the Department of Public Works. In order to receive aid from this appropriation, it is required that local agencies provide money at least equal to the amount of State funds allocated for each item of work.

The amount appropriated by Chapter 1 for repair or restoration of flood damaged property is less than the amount estimated required to fully care for the problem involved but should give material assistance to the damaged areas.

NAPA RIVER BILL PASSED

The Governor also included in his call as Item 3 the consideration of legislation to provide for the acquisition, construction, maintenance and operation of works for control, storage, conservation and utilization of the waters of the Napa River and its tributaries. Senate Bill No. 10, by Senator Gordon, was introduced and passed under this item, several other bills having died in committee.

Senate Bill No. 10, now before the Governor for approval, reappropriates the unexpended balance of \$650,000 made by two former appropriations to the Department of Finance for construction of a dam and distribution system in Napa County to serve the State institutions in Napa Valley. Senate Bill No. 10 expands to a certain extent the service possibilities of the proposed system and removes some restrictions as to contracting powers of the Department of Finance with other State agencies. The Department of Public Works would be affected by the approval of this bill as actual construction on the part of the State would be carried out by the department.

Definition of a man: "Man is a worm in the dust. He comes along, wiggles around a while, and finally some hen gets him."—The Tennessee Road Builder.

Planning to End Sewage Stench on Bridge Approach

IN ACCORDANCE with expressed wishes of Governor Culbert L. Olson, Director of Public Works Frank W. Clark has interested himself in the problem of eliminating the sewage stench that arises from the tideland flats along the East Bay Highway approach to the San Francisco-Oakland Bay Bridge, a problem that has vexed the officials of Oakland, Berkeley, Emeryville and Albany for years.

Director Clark, in letters to the mayors of these cities, proposed that they meet with him to fully discuss the situation with a view to determining what assistance, if any, the State can give in eradicating the obnoxious odors which assail motorists approaching the Bay Bridge over the East Bay Highway.

MOTORING THOUSANDS SUFFER

In view of the fact that the State owns and operates the Bay Bridge, Governor Olson and Clark are anxious to abate the tideland nuisance for the benefit of the thousands of motorists, many from outside the State, who must endure the stench while approaching the span from points east and north of Berkeley, Albany and Richmond on a State highway. The Governor also considers the situation a bad one from the standpoint of public health.

The cities interested in the problem have provided a fund of \$57,000 to defray the cost of a survey to determine how best to cope with the situation. City Engineer Harry Goodridge and Mrs. H. N. Herrick, member of the Berkeley City Council, have informed Mr. Clark that Berkeley would welcome State aid in making the survey.

Because the Santa Fe Railroad Company owns 3000 acres of the tidelands involved, its property line extending 1500 feet out into the bay, Mr. Clark has voiced a desire that officials of this company attend the proposed conference, together with representatives of the Federal Government, to which the East Bay cities look for financial help in work-



ANSON BOYD

ing out their sewage disposal problems.

SEWAGE SYSTEM INVOLVED

Construction of a new outflow sewage system is involved as well as proposals to fill in the objectionable flats by pumping and from San Francisco Bay.

Clark addressed invitations to a conference to Mayors Frank F. Gaines, Berkeley; Dr. W. J. McCracken, Oakland; Al. J. Lacoste, Emeryville; Charles F. Graeber, Albany, and John A. Bell, Richmond. He is awaiting their replies.

Dr. Bertram P. Brown, newly appointed Director of the State Department of Health, has also been requested by Mr. Clark to attend the meeting.

A little boy and his mother were walking down Fifth Avenue in New York. The little boy was looking at the skyscrapers. Turning to his mother he said, "Are there skyscrapers in heaven?"

His mother replied, "No, dear, engineers build skyscrapers."

Taxidermist's Secretary: "Congratulations, the stork has arrived!"

Absent-Minded Taxidermist: "Well, don't stand there. Show him in and I'll stuff him."

Anson Boyd New State Architect

ANSON BOYD of Pasadena was appointed Chief of the Division of Architecture of the State Department of Public Works by Frank W. Clark, Director of the Department, on May 31, the appointment becoming effective June 1.

Mr. Boyd was chosen from the civil service eligible list and succeeds George B. McDougall, retired. Since the latter's retirement on November 1, 1938, the duties of the Division have been under the charge of W. K. Daniels, Assistant State Architect.

Mr. Boyd is a graduate of the School of Fine Arts and Architecture, University of Pennsylvania, where he was the holder of the Sims Memorial Scholarship. He pursued his profession in Philadelphia and New York until 1917 when he was commissioned in the U. S. Army Air Service. He was demobilized in April, 1919, and resumed architectural work in New York. In March, 1923, he took up his residence in Los Angeles, where he became architect for the Los Angeles District Board of Education.

In this capacity, he supervised the expenditure of the \$35,000,000 bond issue which involved the construction of 30 junior high schools, 18 senior high schools, more than 200 elementary schools, gymnasiums, vocational centers, development schools, etc.

In private practice, he helped in the designing of many buildings in southern California, including the California Club, Los Angeles; Beverly Hills High School and Pomona Progress-Bulletin Building.

The new State Architect will take over a large State building program which during the past year and a half under Director Clark has involved the expenditure of upward of ten million dollars and includes the State Prison at Chino, the construction of two State colleges, one at Santa Barbara and one at San Francisco and the proposed Acute Psychiatric Hospital Unit.

"In announcing the appointment," Director Clark said, "I wish to express my appreciation of the very efficient service Mr. W. K. Daniels has given to the State during the time he has performed the duties of the office to which I have named Mr. Boyd."



Break in Butte Slough Levee in Sutter County on March 1, 1940. Flood waters flowed through 1200 foot gap, inundating 35,000 acres of farm lands. Arrow marks far side of break.

Emergency Work on Levee Breaks

By R. L. JONES, Deputy State Engineer

DURING the last days of February, 1940, a storm occurred which caused heavy flood discharges in the upper tributaries of the Sacramento River, resulting in numerous levee breaks. These mostly occurred on February 28 and 29 and March 1. On March 15, 1940, Governor Culbert L. Olson made available to the Division of Water Resources \$60,000 from the State Emergency Fund (Emergency Allotment No. 21, Chapter 655, Statutes 1939), "to close levee breaks in the Sacramento River and its tributaries, caused by flood conditions in February and March, 1940."

Immediately following the availability of funds, steps were taken to close the levee breaks on the Sacramento River and its tributaries in the order indicated by the necessity for immediate future protection. Owing to its urgency, the Division of Water Resources undertook the work by force account.

The breaks which occurred in the levees of the Sacramento River Flood Control Project in Sutter, Butte and Colusa counties were in levees which had not been completed to standard grade and cross-section, so that their repair was undertaken by the California Debris Commission with State and Federal funds as a part of project construction.

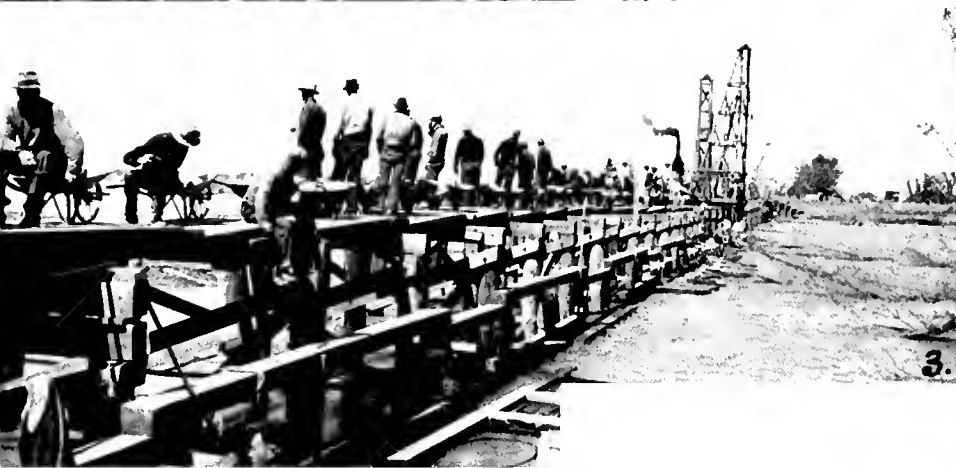
On March 18, 1940, work was commenced on closure of the large break in the Butte Slough levee of Reclamation District No. 70 in Sutter County, which had flooded 35,000 acres of developed farm lands in Reclamation Districts No. 70 and 1660. This work was continued until the late March flood forced its discontinuance on March 29th. This second flood caused a delay in the work of 14 days and an added cost of approximately \$10,000. Work was resumed on April 9th and a closure was finally effected on April 19th at a cost of \$44,560, which entirely cut off water

flowing through Districts No. 70 and 1660 and permitted the farmers to proceed with restoration of their lands to normal use.

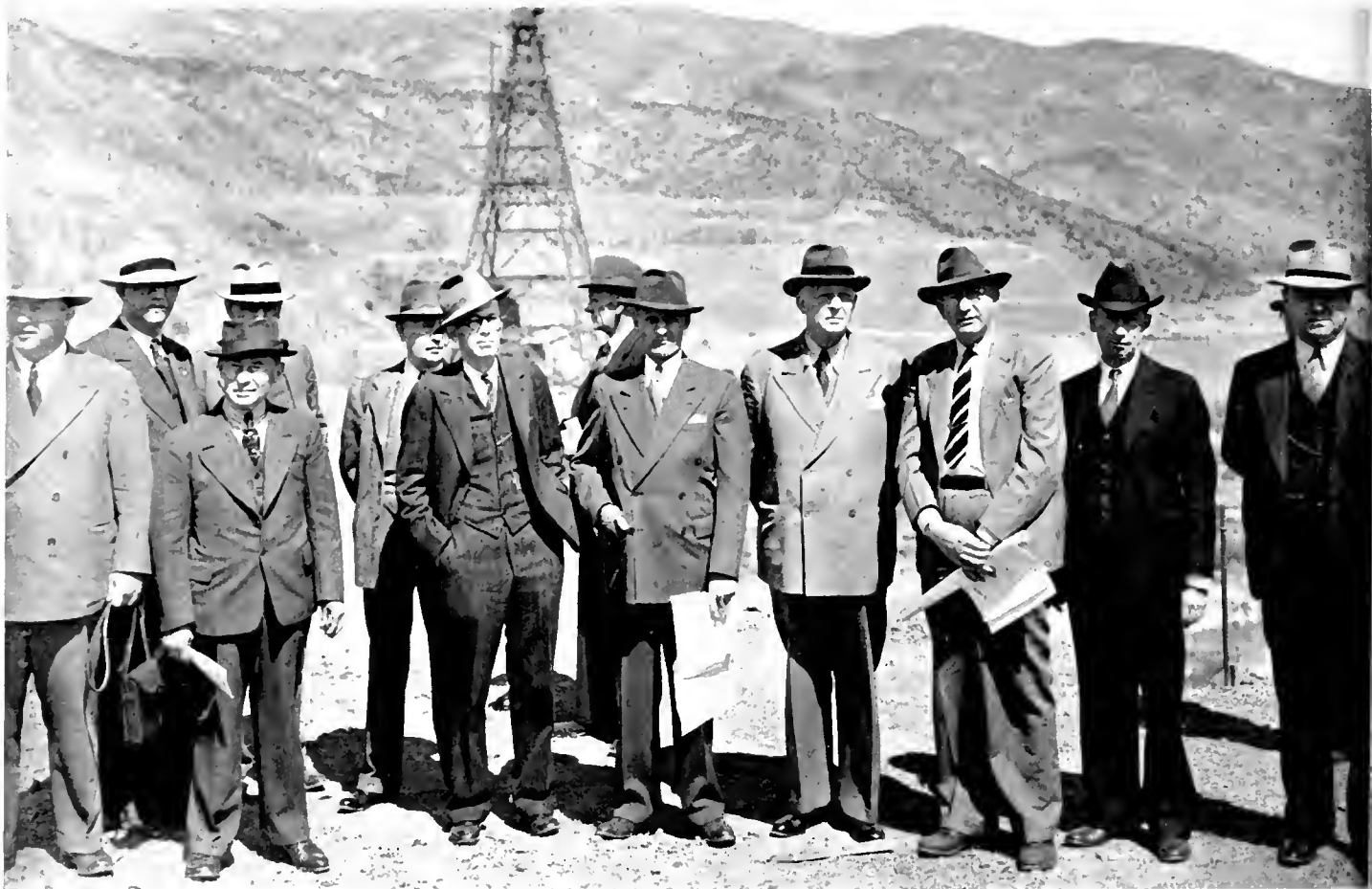
This closure also enabled the California Debris Commission to commence construction of a standard project levee at this location as a permanent repair. This work is still in progress.

The closure structure consisted of a pile and timber bulkhead 700 feet long, faced with light section steel sheet interlocking piling, 18 feet long driven to a minimum penetration of four feet in solid ground. The structure, shown in the illustrations was equivalent to an over-fall dam capable of withstanding 10 feet of water pressure. It was designed so that, in case a freshet should occur, an over fall of water over the crest three feet deep could be sustained without damage.

Had the structure been completed at the time of the second flood, it



Construction views of timber and steel sheet pile emergency overfall dam in Butte Slough, 700 feet long with two wing levees. Total length, 1100 feet. 1—Bulkhead showing 3 drivers at work. 2—Final closing of steel piling. 3—Laborers wheeling cobbles for bottom protection in closure section. 4—Bulkhead showing steel piling. 5—Drivers at work on structure. 6—One of wing levees.



Governor Olson and official party on an inspection tour of Shasta dam and other highway and bridge units of the Central Valley Project. Left to right—Jesse W. Carter, Supreme Court Judge; A. J. A. Johnstone, C. J. McConnell; Superior Court Judge Albert F. Ross; A. H. Gronewoldt; State Engineer Edward Hyatt, Manly Harris; Director of Public Works Frank W. Clark; Governor Culbert L. Olson, Engineer R. W. Lowrey, U. S. Bureau of Reclamation; Judge Francis Carr, S. F. Finley.

would not have been damaged, but water would have passed into Districts No. 70 and 1660, although in a greatly lessened quantity and with an earlier complete stoppage of flow. The bulkhead structure described above was provided with substantial abutments which were connected to the intact levee along Butte Slough by wing levees on the north and south of the break wash with an aggregate length of 1200 feet. On completion by the California Debris Commission of the final repair, the material in this structure may be salvaged.

On March 19th, equipment was at work closing breaks in the levees of the Sacramento River above Princeton, in Glenn County. This work was continued until taken over by the California Debris Commission on March 23, 1940. By that time the fills in six breaks had been brought to an elevation considered safe from normally expected spring freshets. At Robinson Bend on the Feather River, in Butte County, levee breaks and bank washes were repaired, commene-

ing on April 5th, to a height expected to be safe against expected spring freshets.

On April 19th levee repairs were undertaken in Butte and Tehama counties, in conformity with recommendations of the Northern California Water Control Association, representing eight counties. Work has been completed at 15 places, 32 breaks having been closed, and about three more breaks will be repaired with the unexpended balance of the emergency allotment, which on June 1st was approximately \$4,000.

PHOTO CREDIT LINE OMITTED

Through an oversight, credit for the picture on the front cover of the May issue of this magazine was not given to C. D. Clearwater, Publisher of the PALISADIAN newspaper of Pacific Palisades, who took the photograph and kindly donated it to California Highways and Public Works.

The photograph showed a spectacular view of the bluff sealing work with a large bulldozer on the precipitous cliffs fronting the Coast Highway along the Pacific Palisades north of Santa Monica.

Post Roads in U. S.

Adequate highways are needed to carry on most of the functions of government. Mail is moved between post offices on 290,000 miles of main routes. Rural free delivery of mails extends over routes totaling 1,390,000 miles of public roads (exclusive of city delivery).

Such governmental use of the rural roads presupposes a Federal responsibility to contribute materially to the cost of construction and maintenance of roads. The responsibility was accepted definitely by the Act of Congress of July 11, 1916, entitled "An Act to provide that the United States shall aid the states in the construction of rural post roads, and for other purposes" and by subsequent amendments to that Act.

A son at college wrote to his father, "N mon, no fun, your son."

The father answered, "How sad, too bad your dad."

California Highway Program Requires More Federal Aid

By C. H. PURCELL, State Highway Engineer

In the May issue of this magazine, State Highway Engineer C. H. Purcell expressed some views on the subject of Federal Aid to States for highway construction and discussed provisions of a bill now pending in Congress to authorize the Reconstruction Finance Corporation to make loans at cost for highway work to States which are in a position to borrow such funds. Governor Olson sent Mr. Purcell to Washington last January to urge favorable consideration of the bill by the Roads and Highways Committee of the House of Representatives. In the following article Mr. Purcell deals with the highway situation in California in relation to the measure now being considered by Congress.

I WISH to discuss Title II of the bill before Congress from the standpoint of the State of California, and which, I believe, is also of interest to other States having a large population, and that is the question of traffic in urban areas. Urban areas include oftentimes more than the actual city limits of the metropolitan city and extend for some distance beyond such limits. The resulting problem is a great deal larger than is universally understood, although it is thoroughly understood by the metropolitan areas affected and the States which deal with such problems.

Our Federal-Aid System passes through and sometimes around our large cities. It is a part of the Federal-Aid System, so when we speak of this metropolitan problem, it becomes part of our Federal Aid problem as such and should not be considered as separate and distinctive.

LOS ANGELES PROJECTS

With reference to our rural roads, Governor Olson, Director of Public Works Frank W. Clark and the Highway Commission are concerned with keeping up with the trend of the times. Therefore, we are not suggesting any reduction in the program on our Federal-Aid System. Feeder roads are also of much importance, reaching the outlying sections and, were it not for this feeder road money, we would be forced to slow down on our primary roads.

The addition of the one-cent gas tax by the Federal Government to existing State gas tax increased this tax to the point where it makes it

much more difficult for the States to increase their gas tax to help solve these problems. The problem in California, which is typical of some of our larger metropolitan areas in other States, is this:

In Los Angeles, there has been spent a large amount of money in completing a study and report on the traffic situation in this metropolitan area; likewise, a similar survey in the San Francisco Bay area, to find out exactly the origin and destination of traffic, what this traffic is doing, what time is spent traveling on city streets, the time of congestion, and other information affecting motor transport. We are faced with a traffic movement problem in the city of Los Angeles, involving some 180 to 200 miles of city streets, where congestion exists to the extent that it is city-wide.

COSTLY RIGHTS OF WAY

Entering into the picture of metropolitan development, the State of California is developing a system of connecting streets in Los Angeles as a State function, amounting to approximately \$8,500,000 biennially, by the allocation of a percentage of the gasoline tax funds based on population, as well as an additional contribution of State funds. This has resulted in a further postponement of the development of rural roads.

The act before Congress refers to excess condemnation, which is a misunderstood term. What is excess condemnation? A case of this nature has actually developed in that we spent some \$8,000,000 in the purchase of rights of way through an organized

right-of-way department with skilled appraisers. In acquiring this right of way, it was more economical to purchase entire blocks and, after razing improvements on them, we used what land was required for highway purposes and resold the remaining portions, resulting in this property again being placed on local tax rolls.

Another matter is the question of approaches. We have had to acquire buildings, which were in the way of a proper approach, or destroyed visibility, and which would interfere with a clean-cut, finished appearance.

While we are not interested or anxious to engage in speculative ventures in real estate, we are interested in the chance to secure a loan or lease or rental from the Federal Government or direct Federal aid on a reasonable basis. I believe that motor transport, which is a business of large future possibilities, represents a safe investment, at least as safe as any other large business. This is a growing business and is not on the way out.

QUESTION OF FORMULA

The question of formula has been raised. We naturally are always interested in a formula if any money is to be allotted to the States by Congress. I do not know whether this matter is to be followed up. If it is, there is one phase which must be considered in regard to the metropolitan or urban areas in regional highway development, and that is a complete study of traffic such as has been made in California as a cooperative Federal and State project.

(Continued on page 26)

Redecking the Yolo Causeway

By W. E. SUTTON, Resident Engineer

THE Yolo Causeway, an important link in the State Highway System five miles west of Sacramento, is now being redecked. This structure 16,538 feet long is on the main route from San Francisco to Sacramento.

The Yolo basin, which is 3.13 miles in width at the bridge site, affords a by-pass for the periodic overflow of the Sacramento River. This by-pass is flooded annually for three or more months during the winter when the heavy runoffs occur on the Sacramento River. The water is diverted into the by-pass to avoid overflowing of the levees of the main channel of the river.

The structure was first opened to traffic 24 years ago. At that time it had a roadway width of only 21 feet, which was ample for the traffic. It was a combination timber and concrete trestle type structure with a 113 foot plate girder bascule span equipped

with hand operated machinery. The bascule span is for the purpose of allowing passage to floating dredgers utilized in the repair and maintenance of the levees.

The timber construction comprised one hundred thirty 19-foot spans for a length of 2470 feet at the west end. The substructure consisted of four creosoted piles in each bent and untreated Douglas fir caps. The superstructure consisted of untreated Douglas fir stringers and an untreated 2 by 4 inch laminated fir subflooring with an asphaltic concrete pavement.

The concrete portion of the trestle at the east, or Sacramento end, consisted of 19-foot reinforced concrete spans supported on reinforced concrete piles and caps.

The timber portion of the trestle at the westerly end was constructed for economic reasons. In a permit granted to the State Highway Commission by the State Reclamation Board, it

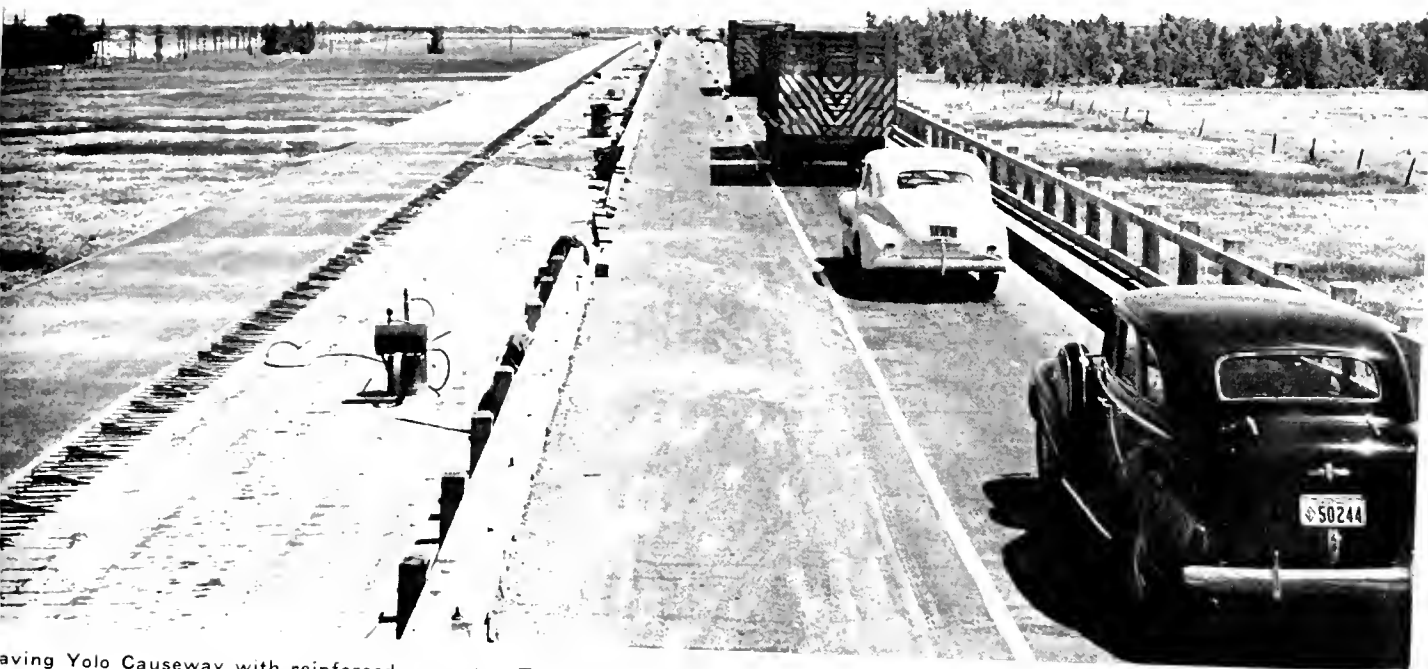
was provided that upon construction of a new levee approximately one-half mile from the west end of the causeway, the structure could be shortened to meet this levee and replaced with an embankment. Under these conditions construction of a permanent concrete structure was not justified. However, the California Legislative Act of July, 1927, established the boundaries of the west levee at the west end of the structure, thereby making it mandatory to maintain the structure for the full distance of 16,538 feet.

In 1932 increased traffic necessitated the widening of the causeway. Its widening was chosen as an emergency relief project to provide employment for local people during the height of the depression. For this reason a redwood timber trestle was constructed along the south side, and thus was provided a clear roadway

(Continued on page 32)



Yolo Causeway, a 16,538 foot concrete and timber trestle structure across Yolo By-Pass on U. S. 40 near Sacramento being redecked and paved.



aving Yolo Causeway with reinforced concrete. Traffic is kept moving in two of the four lanes while work is under way on the other two except for intervals while concrete is setting when one-way traffic control is in effect.

State and U. S. Building Approach Road to General Grant Park

By C. F. WAITE, District Office Engineer

EAST of Fresno lie some of the most spectacular portions of the High Sierras. Embraced in this area are Sequoia National Park, General Grant National Park and far famed Kings Canyon Country. After many years of effort a great portion of the High Sierras has recently been placed in the Kings Canyon National Park, and General Grant National Park has been enlarged to include additional groves of huge Sequoias and is now a part known as the General Grant Grove Section, of the Kings Canyon National Park.

In the development of this vast wonderland the State and the Public Roads Administration acting for the National Forest Service and the National Park Service have expended large sums for highways. The State built the highway from General Grant Grove down into the Kings River Canyon, some 24.5 miles to Deer Cove Creek. Here the Forest Service, with Civilian Conservation Corps labor took up the task and continued construction about three miles to Cedar Grove.

At the same time the Federal Government was busy building a modern

highway, the General's Highway, between General Grant Grove and Sequoia National Park.

ACCESS ROAD NEEDED

As this construction in the high mountains neared completion, attention was directed to providing for a suitable access road from the valley. There was an existing county road from Fresno, via Centerville, Minkler, Squaw Valley, Dunlap, Pinehurst to the General's Highway near General Grant Grove Section. This county road was taken into the State Highway System for maintenance in 1933. This road is the old mountain type with narrow tortuous alignment, steep grades and inadequate sight distance.

This road was adequate until the development in the back country created such a demand for an easier, faster approach to these scenic highways. To meet this demand the Federal Government as early as 1931 began the survey and relocation of the approach road from General Grant Grove, or as then known General Grant National Park, westerly toward Dunlap and Fresno.

An entirely new location was made, which with the exception of the first

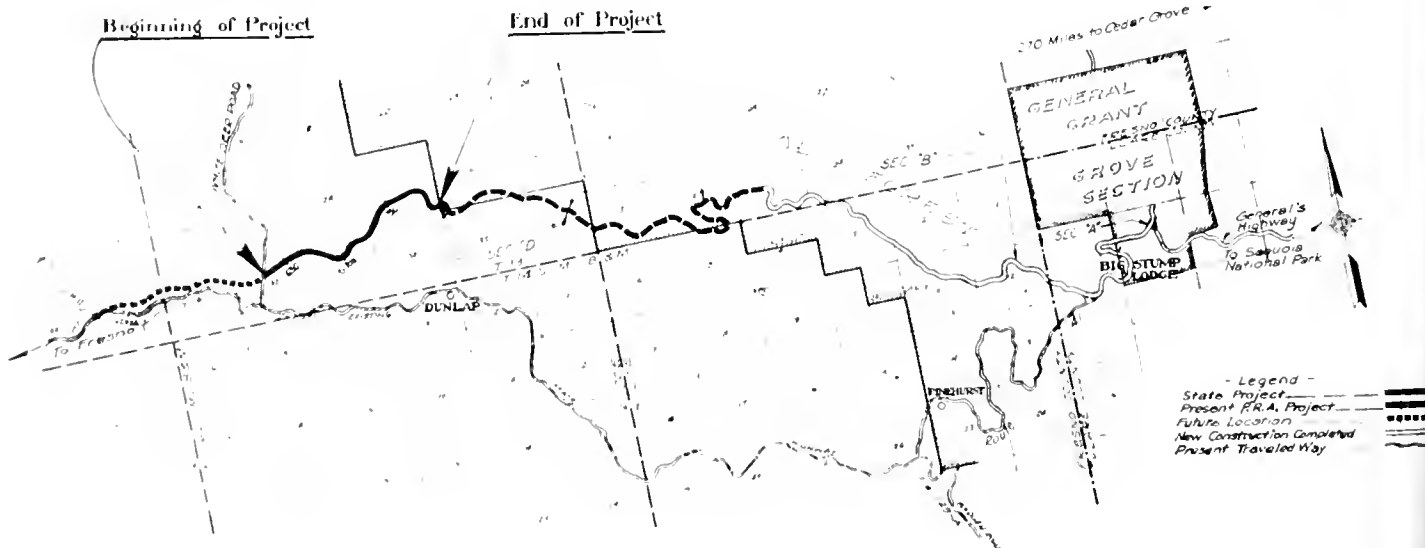
two miles or so from the Park is far removed from the present road, and does not again intersect the old road until the crossing of Mill Creek is reached, some five miles or more west of Dunlap.

In carrying out this program the Federal Government has already completed grading and oiling from Grant Grove westerly about 8.5 miles. This section is now under traffic since Fresno County has reconditioned and oiled an old county road from Dunlap easterly to the west end of the completed road.

The use of this county road lessens to a very great extent the number of miles of winding mountain road traveled in going to the back country. The Federal Government expects within a month or so to complete the construction of the approach road to the Forest boundary about 6.2 miles, the limit of full Federal financing.

STATE LINK STARTED

The State is now taking up the work and with Federal cooperation will continue construction westerly of the Forest Boundary. Bids were opened on the first section, Forest Boundary to White Deer Road on



May 1st. The contract was awarded to Heafey Moore, Frederickson Watson Co. This section involves the construction of slightly more than three miles of road. The fact that 310,000 cubic yards of roadway excavation will be moved is indicative of the magnitude of the work.

No unusual construction difficulties are anticipated on the present project and barring unforeseen or unpredictable occurrences this section should be completed this fall. The present project does not contemplate surfacing other than a road mix of the native disintegrated granite.

This State construction will not join up with the present traveled way. Fresno County has volunteered, however, to put the White Deer Road in good condition so that traffic can be carried to the new construction

(Continued on page 23)



At top, Construction of rock retaining wall on PWA link of Grant Park approach road. Bottom, Drilling for removal of cliff.

Bay Bridge Traffic Breaks All Records With Opening of the Fair

By RALPH A. TUDOR, Principal Bridge Engineer, San Francisco-Oakland Bay Bridge

MAY traffic on the San Francisco-Oakland Bay Bridge exceeded all past records and totaled 1,202,577 vehicles. This traffic was materially affected by three major events during the month of May. At midnight on the 16th the Southern Pacific Golden Gate auto ferries ceased operating between the East Bay and San Francisco; tolls on passenger autos were reduced another 5 cents to 30 cents on the 25th; and the Exposition on Treasure Island opened its gates to the public on the same date. In fact the exposition was an influencing factor before the 25th because of the heavy commercial traffic preceding opening.

The discontinuance of the ferries evidently diverted about 4000 additional vehicles per day to the bridge of which a high proportion was trucks. Since the day the bridge opened the ferries have been fighting a losing battle. They have been operating for almost 90 years and reached their peak in 1930 when they carried over 4½ million vehicles between the East Bay and San Francisco. However, they were slow and expensive. The average toll charged just before the bridge opened was 83 cents. They met the initial reductions brought about by the bridge but still suffered a 90 per cent loss of their traffic. They then drastically reduced their passenger auto tolls, but not truck tolls, to about half those on the bridge. This recovered some traffic. Several ferry routes were abandoned and schedules reduced. However, continued high traffic on the bridge and a reduction in interest rate on the money borrowed permitted the bridge to successively reduce its tolls on all types of vehicles. Traffic remaining on the ferries dwindled until it amounted to only about 40 per cent of its 1930 peak. Revenues were reduced a great deal more because of reduced tolls. Under the

Passenger Autos and Auto Trailers

May 1940	May 1939	April 1940	Total Since Opening
1,093,789	761,650	874,469	32,059,916

Motorcycles and Tricars

May 1940	May 1939	April 1940	Total Since Opening
4,513	3,759	3,788	146,474

Motor Buses

May 1940	May 1939	April 1940	Total Since Opening
21,866	17,350	17,970	530,627

Trucks and Truck Trailers

May 1940	May 1939	April 1940	Total Since Opening
61,874	47,352	49,231	1,559,548

Other Vehicles

May 1940	May 1939	April 1940	Total Since Opening
20,535	17,814	18,346	550,777

Total Vehicles

May 1940	May 1939	April 1940	Total Since Opening
1,202,577	847,925	963,804	34,847,342

combination of convenient, fast, and cheap facilities provided by the bridge, the outmoded ferries could not compete and the doom which was foreshadowed on November 12, 1936, was sealed on May 16, 1940.

Preliminary figures indicate that this year the proportion of persons going to the exposition by private auto over the bridge will exceed even last year's high figure. This is not unexpected since the bridge toll is only 30 cents for a round trip and the island parking fee is cut in half. Furthermore, the method of handling automobiles on the island has been radically changed

and has already proved to be a great improvement over 1939. On May 25, 17,038 vehicles entered Treasure Island and at no time was there any delay or congestion on the bridge. The maximum number of vehicles thus handled last year was 19,845 at which time the congestion was severe. It is not anticipated that there will be any such difficulty this year.

Ferry service to Treasure Island from the East Bay proved to be quite unsatisfactory in 1939, and for 1940 a fast, convenient bus service across the bridge has been substituted. This again has increased the bridge load.

The third toll reduction within a year, and the fourth since the bridge was opened, went into effect during the month. Passenger autos now pay only 30 cents. A corresponding reduction in the commutation rate went into effect on June 1. It is anticipated that a corresponding reduction in truck rates can be effected within a short time.

The heaviest day's traffic occurred on May 25, when 54,737 vehicles used the bridge. Since the collectors must handle those vehicles traveling between the East Bay and Treasure Island three times, they handled almost 70,000 transactions that day. This compares with 75,218 transactions on the bridge's heaviest day of November 15, 1936.

The first part of May the daily traffic averaged 34,568 vehicles per day. After the ferries discontinued and the exposition opened, the average was 45,605. The average for the entire month was 38,793 per day.

Rain and cold weather reduced the normally heavy Memorial Day traffic.

Traversing the bridge, which ultimately will be a toll-free State highway, and without which Treasure Island probably never would have come into existence, thousands of visi-

(Continued on page 22)



At top—Treasure Island showing how the Golden Gate International Exposition is reached via the San Francisco-Oakland Bay Bridge. Below is a portion of the 6-lane State-built ramp approach. At bottom—Automobiles waiting for the gates to open early on the first day.

Bay Bridge Tolls Cut To 30 Cents for Automobiles

MEETING in Sacramento on May 9, the California Toll Bridge Authority voted to lower automobile tolls on the San Francisco-Oakland Bay Bridge from 35 to 30 cents, thus effecting the third reduction in rates since Governor Culbert L. Olson assumed office as the State's Chief Executive and as such became chairman of the Authority.

The new tolls for automobiles, automobile trailers and related vehicles went into effect on May 25 and a corresponding decrease in commute rates for passenger automobiles became effective on June 1.

A reduction in truck tolls will be made as soon as traffic justifies, probably within the next few months.

On May 6, Director of Public Works Frank W. Clark approved a reduction in bus fares in line with expressed wishes of the Toll Bridge Authority.

The new schedule of tolls is as follows:

Class	Vehicle	New Rate	Old Rate
1.	Automobiles, ambulances, taxis, commercial or light delivery automobiles	.30	.35
2.	Trailers drawn by automobiles	.30	.35
3.	Trucks or truck trailers, including any load:		
a.	(To remain in effect until Rate 3b below is ordered.)		
	Gross weight up to 20,000 lbs., per ton at		.175
	Additional gross weight from 20,000 lbs. to 40,000 lbs., per ton, at		.15
	Additional gross weight over 40,000 lbs., per ton, at		.125
	Minimum charge		.50
b.	(To be made effective on order of the Director of Public Works.)		
	Gross weight up to 20,000 lbs., per ton, at	.15	
	Additional gross weight over 20,000 lbs., per ton, at	.125	
	Minimum charge	.50	
4.	Local Key System buses, per passenger carried	No change	.025
5.	Other buses—Bus with driver and passengers	1.00	.75
			per bus, 5c per each passenger
6.	Motorcycles	No change	.15
7.	Tricars	No change	.25
8.	Vehicles requiring special permit, per ton gross weight*	No change	.20
	Minimum charge*	No change	1.00
9.	Vehicles not otherwise specified:		
a.	(To remain in effect until Rate 9b below is ordered.)		
	Per ton gross weight		1.75
	Minimum charge		.50
b.	(To be made effective on order of the Director of Public Works.)		
	Per ton gross weight	.15	
	Minimum charge	.50	.50
The following monthly commutation rates are prescribed:			
10.	Commutation—For passenger automobiles only. Book to contain from 50 to 54 one-way trip tickets (depending on length of calendar month) good for the calendar month	10.75	12.25
	In addition the book will contain twenty (20) provisional tickets, each good for a one-way trip upon presentation and payment of twenty-five cents (25¢) provided all regular tickets have been used.		
	Additional provisional tickets for the same calendar month will be issued upon surrender of the complete empty cover—front and back—of a \$10.75 book of the same month.		
11.	Commutation—For passenger automobiles only. Book to contain 40 one-way trip tickets, good for the calendar month	9.00	10.25
	In addition the book will contain ten (10) provisional tickets, each good for a one-way trip upon presentation and payment of twenty-five cents (25¢) provided all regular tickets have been used. Provisional tickets, in excess of the above, will not be issued to purchasers of this book.		

(Vehicles exceeding limits of special permit to be assessed double this toll.)

Bay Bridge Traffic Breaks All Records

(Continued from page 20)

tors to the 1940 Golden Gate International Exposition daily are traveling over a State-built approach which rounds Yerba Buena Island from the great bay span and leads directly into the Fair Grounds.

The Division of Highways constructed the road on Yerba Buena and the approach from the island to the Fair site for the 1939 Exposition Company, thus creating an integral temporary highway link from the Bay Bridge to Treasure Island.

In the California Building, the Division of Highways has also constructed a large diorama comparing the highways of today and tomorrow depicting the highways common throughout the country with grade crossings, left turns, narrow and poor surfacing.

"Highways of Tomorrow," which is attracting many visitors, shows a double four-lane ribbon of roadway, with a parking strip between. There are no left turns, no railroad crossings and no sign boards. Overhead structures and underpasses remove the possibility of collisions at both highway and grade crossings and modern clover leaf designs at intersections provide safe entrance and exit.

Another diorama in the California Building shows modern type highways through mountains, redwood forests, and broad meadows and includes a most realistic scene of heavy equipment at work, grading for the highway relocation in a mountainous section made necessary by the construction of the Shasta Dam unit of the great Central Valley Project.

As a result of the combination of convenient, safe, and cheap facilities provided by the Bay Bridge, indications are that the new Exposition will roll up an attendance record greater than that of 1939 for the corresponding May period.

A report for the weekend of the 1940 season (May 31-June 2, inclusive) with the corresponding weekend for 1939, which would be June 2, 3, 4, shows the exposition had 248,993 paid admissions in 1939 while this year totaled 407,352.



New grade on Santa Barbara coast highway reconstruction runs between existing highway on left and railroad on right.

Santa Barbara Highway Project

(Continued from page 9)

plant-mixed material on the detours in order to expedite their construction and permit grading to proceed without delay.

TRAFFIC INCREASE

Highway traffic in this vicinity has increased at the midsummer counts on Sunday and Monday from 2800 and 2200, respectively, in 1928 to as high as 4400 and 3500 in 1937. It is estimated that the traffic in 1965 will reach an hourly peak of 740 vehicles.

The accident record on this section of highway indicates that those accidents reported totaled 11 between the years 1936 and 1938, inclusive, with five of these accidents involving two cars and six involving one car. All of these accidents involved injury and two involved fatalities. It is believed that the above figures represent less than 50 per cent of the accidents that have occurred on this section although the accidents noted above probably covered most of those involving serious injury or fatalities.

The grading work has progressed very well, considering the sporadic rainfall which has occurred on the job this spring. The contractor, R. E. Hazard & Sons and Clarence Crow, expects to complete the entire job about August 15th, although the contract date for completion is October 30th.

This work is being performed under the direction of John C. Adams, Resident Engineer for the State.

YALE OFFERS 7 FELLOWSHIPS

The Bureau of Street Traffic Research of Yale University is offering nineteen graduate fellowships beginning September 26, 1940, of which seven are available only to employees of State highway departments.

The fellowships provide a living stipend of \$800 dispensed at the rate of \$100 per month for eight months, and a tuition fee of \$400. In addition a maximum of \$200 is available to each Fellow for scheduled field investigations. The Bureau has just published "A Library Classification and Sample Bibliography of Traffic Engineering Materials."

Gen. Grant Park

(Continued from page 19)

about one-half mile and thus make available this additional nine miles of high type highway at an earlier date than would be possible otherwise.

MANY CURVES ELIMINATED

Statistics of the old road are not available and it is doubtful if surveys were ever made of the old road. The curvature eliminated will amount to many full circles. There are many curves of less than 50 foot radius and the grades approach 10% if in some cases it is not exceeded.

The new road within the Forest, constructed by the Federal Government, has minimum radius curves of 300 feet except one of 225 feet and one of 275 feet. All curves under 1000 feet radius are spiralled. A maximum grade of 6% compensated is used.

On the State work the maximum grade uncompensated is 6%. Minimum radius of curvature is 700 feet with exception of one 500 foot radius curve at the Forest Boundary.

State Supervised School Buildings Unhurt by Imperial Valley Shake

By D. C. WILLETT, Supervising Structural Engineer

CALIFORNIA'S luck still held when a destructive temblor shook the Imperial Valley from 8:36 p.m. intermittently for over an hour on May 18th, for the shock came at a time when schools were unoccupied and but few people were in the business district.

Structural engineers of the Division of Architecture from Sacramento and Los Angeles were ordered to the district to assist county, municipal and school officials in investigating the resultant damage. These engineers assisted the county superintendent by inspecting the buildings in the Moreland, Verde, Acacia, Imperial, Magnolia, Alamitos, Eastside, Sunset Springs, Palmetto, and McCabe school districts, and the trustees of the Brawley, El Centro, Calexico, Mulberry and Holtville school districts by determining the structural condition of their buildings after the shake.

Schools built prior to 1933 were without exception found lacking in the necessary stability to assure safety. Some were shattered beyond economical repair. Chimneys came through the ceilings carrying with them portions of the roof and floor framing. Entire ceilings dropped in some instances, wall plastering and blackboards were dislodged and thrown into the room, gables were shaken loose, and concrete and brick walls shattered.

The loss to the Brawley elementary school district alone has been estimated between \$250,000 and \$300,000.

The one bright side of the picture is that not a single one of the fifteen new school buildings built in the Imperial Valley under the jurisdiction of the Division of Architecture was damaged in any way, not even to minor cracking of the plaster.

In all parts of California, as well as many other localities, history has proven that we may anticipate the occurrence of earthquakes of varying durations and intensities, at irregular intervals. The Imperial Valley earth-



Ceiling dropped to floor in one old school.



New Brawley Union High School buildings were undamaged.

quake was the 28th destructive one to occur in California in the last hundred years, but it was not until 1933 that State legislation was enacted to provide some degree of safety in the construction of buildings.

This was accomplished in the enactment of Chapter 59, known as the Field Bill, regulating school construction, and Chapter 601, known as the Riley Act, regulating building construction in general with minor exceptions. The wisdom of this legislation was certainly impressed upon the inhabitants of the Imperial Valley and those visiting the area, for all buildings constructed in compliance

with these acts are a testimonial to the efficiency and assurance of safety secured through state supervision.

The cost of the new schools which withstood the shock has been but very little more than those that failed. In checking over the some 3300 school projects supervised by the Division of Architecture, totaling over \$140,000,000, it is the belief of the division that the additional construction expense over what the buildings would have originally cost has been less than 2 per cent. It should be remembered that the additional 2 per cent has been spent in strengthening and making



Heavy equipment at work excavating, grading and constructing fills for highway relocation on Central Valley Project north of O'Brien.

the building safe, the main expense being in the strengthening of the structural portion of the building, which portion represents from one-fifth to one-third the actual cost of the entire building.

"The public can have every assurance that new school buildings as well as those being reconstructed will be safe against earthquakes of rather severe intensity such as have been experienced from major earthquake shocks in the past on the Pacific Coast." This statement was made and published by the Division of Architecture in 1934 and reaffirmed in the Imperial Valley.

Schools which have the approval of the State Division of Architecture are safe in an earthquake. The Long Beach earthquake of March 10, 1933, gave an unmistakable and drastic warning to school trustees that schools existing on that day were hazardous.

The schools inspected by the Division since that day have further substantiated such a conclusion and another warning has been repeated in the Imperial Valley earthquake of May 18, 1940.

Relocation North of Shasta Dam

(Continued from page 7)

The grading is progressing at a rapid rate, all work being done with tractors, bulldozers and 25 to 28 cubic yard scrapers. The probable final cost of this unit is approximately \$416,238.

In February, 1939, a contract was awarded to the United Concrete Pipe Company for the construction of a bridge across the Sacramento River, near Antler. The bridge will be 1330 feet long and will cost \$716,588.

In April, 1940, bids were opened for grading 8.01 miles from O'Brien Summit to near Antler. Contract for this unit which will complete the grading for the highway relocation was awarded to Granfield, Farrar & Carlin. The work involves the movement of 1,393,000 cubic yards of excavation and the construction of a special arch culvert below the high water level of the reservoir at Salt Creek. The cost of this unit will be \$393,737. Work on this project is in progress.

The last contract for work to be

done by the State will be for surfacing and will be awarded in 1941, although not in time to complete during that year. Surfacing will consist of crusher run base and plant-mixed bituminous-treated top, except through the Southern Pacific subway where Portland cement concrete will be used. The estimated cost of this surfacing is \$335,000. The exact date for award of this contract will be determined by the rate of progress on the Pit and Sacramento River bridges.

Highway standards are somewhat improved over those of the existing roadway, which furnishes the necessity for State participation in the cost.

The double-deck Pit River bridge to be used jointly by the Southern Pacific and the State highway is being constructed by two contracts, under the supervision of the Bureau of Reclamation. The Union Paying Company is constructing the substructure, and the American Bridge Company will construct the superstructure. This bridge will be 3590 feet long.

Highways Need More Federal Aid

(Continued from page 15)

We must take into consideration the number of registered vehicles and the amount of traffic produced in these urban areas in relation to the registration and traffic lying outside of the urban areas. Such a consideration should be made a part of any formula which is developed. Probably other items will have to be taken into consideration, although I have not studied the problem to a great extent, but it would appear that traffic and registration would cover a formula for the States to follow.

We are in agreement with that part of section 2 of the congressional bill which stipulates that the States shall be the one agency for coordination with the Federal Government, because urban development overspreads county boundaries and is not confined to municipal limits. It also has a definite relation to the Federal Aid System, which is a vital one.

TRAFFIC DELAY

An example of traffic delay which we found, citing the city of Los Angeles as a typical case, was that the average speed on a city street is around 16½ miles per hour, while on an express highway or freeway, this speed will increase from 30 to 43 miles per hour. This will give an idea of the saving in time, for which the motorist will and can pay.

Our State highway system contains 14,000 miles, including about 7000 miles in the Federal Aid Highway System. The construction of the Federal Aid System was started many years ago.

Obsolescence is not figured entirely in materials. One point of obsolescence is light surfaces placed at a time when capital was not available to produce a heavier surface. Another is location. In the early days in order to serve traffic, locations followed contour and section lines. These were limited to speeds of 25 to 30 miles per hour. Today it is 45 or better. To take care of these changed conditions, location is brought into the picture. You can not meet these present day conditions by following the old location.

Still another point of obsolescence is our bridge problem, brought about

principally by commercial vehicles, heavier loadings and faster speed. It is the overloading of these structures, combined with deterioration to an unsafe condition through the years, which has produced obsolescence in our bridges. In California, legislation has been enacted which permits structurally unsound bridges to be posted for less than the legal load and speed limits. We have many bridges which have been posted for five tons or less which are used for moving lumber, farm products to market areas and other forms of commodities.

Practically our entire farm product is moved on trucks and trailers to rail heads and harbors. The necessity of retiring these narrow, defective structures is quite apparent from the standpoint of service, as well as eliminating a dangerous and increasing hazard to traffic; but we find ourselves able to finance only a small portion of these structures, resulting in the continuation of posted bridges.

One form of obsolescence takes place when business establishments locate along relocated highways until they destroy the use of the highway to through traffic, caused by local congestion.

REVENUE BOND FINANCING

With Governor Olson and Director Clark, I am convinced that revenue bond financing, guaranteed by the gas tax or tolls and whatever Federal aid may be available for cooperation, is necessary in the solution of our metropolitan transportation problem.

Public utilities are financed on the principal of revenue bonds, where their lines and other facilities represent the investment and the distribution produces resources to retire these bonds and furnish dividend rates on common and preferred stocks. Highway traffic is now paying for itself; and the Government, through the Reconstruction Finance Corporation, was one of the first to recognize that revenue bonds could be made respectable; and in our particular case, they were made respectable by reselling San Francisco-Oakland Bay Bridge bonds to private interests at a substantial profit.

It has been my experience on many large projects that money will be obtained at a lower rate and will be more efficiently expended on highways if there is a cooperative relationship between the Federal Government, the States and municipalities.

LOANS IMPORTANT

We feel that a loan contribution by means of our ability to sell to the Reconstruction Finance Corporation for the purpose of acquiring rights of way, is a very important issue. In many States, new legislation would be required. While it is quite probable that not over 10 to 15 States will be able to take advantage of such loans, in most of those States local legislation must be adjusted.

A State taking advantage of these loans will find itself in the position of being able to give more benefit to the rural areas in that such loans will prevent or postpone the transfer of much needed gas tax funds from the rural areas, which otherwise would be required for solving city problems. The solving of this city and town problem will be a benefit to economical transportation, at least the equal of anything heretofore accomplished by Federal and State cooperation.

We have the means of constructing these metropolitan highways, but the right of way problem is so large that it would not begin to start the metropolitan development we have planned in Los Angeles.

At the present time, we are constructing only one express highway, known as the Arroyo Seco Freeway, connecting Pasadena and downtown Los Angeles. We have received a PWA grant and sponsor funds are being contributed by the State.

Where we can not secure sufficient direct Federal aid and want to go as far as we can with our own funds, we still do not want to take money from our rural funds and put it into the urban areas.

NO DANGER IN LOANS

I see no danger in the principle of a law which permits the Reconstruction Finance Corporation and the Public Roads Administration,

(Continued on page 28)



THANKS FOR SIGNS
CHAMBER OF COMMERCE
Azusa, Los Angeles County

March 27, 1940.

Mr. Frank W. Clark,
Director of Public Works,
Sacramento, California.

Dear Mr. Clark:

For the Azusa Chamber of Commerce and the traveling public, I wish to thank you for your interest in having the Crystal Lake Park signs erected on U. S. 66 and California 39 in Azusa and on Holt Avenue and Azusa Avenue in West Covina. The signs were erected yesterday by the Automobile Club and certainly are a credit to the State Highway Department and I know will be appreciated by the autoists desiring to know the turning point to this most popular public recreational area.

Our thanks and best wishes,

Respectfully,
CORNELIUS SMITH, Secretary.

GIVES VALUABLE DATA
NATIONAL AUTOMOBILE THEFT
BUREAU

San Francisco, California

California Highways
and Public Works,
P. O. Box 1499,
Sacramento, California.

Dear Sirs:

Will you kindly place my name upon your list to receive copies of your excellent journal which is issued monthly. I have seen copies of the Journal and find that it contains much valuable information and important data which I can use in speaking before various law enforcement agencies and civic organizations.

Thanking you, I remain,

Very truly yours,

C. F. CLINE,
Special Agent in Charge.

Lodi, California.

California Highways
and Public Works,
P. O. Box 1499,
Sacramento, California.

Gentlemen:

I have been a reader of your publication "California Highways and Public

Works" for a number of years but have never had a copy of my own.

I think that the publication is well worth while, both in the manner it is put up and its contents. Will you please put me on your mailing list.

Sincerely yours,

(Signed) E. REIMCHE.

CREDIT TO STATE
AMADOR COUNTY
CHAMBER OF COMMERCE

Jackson, California.

California Highways
and Public Works,
Sacramento, California.

Gentlemen:

It has been our pleasure for some time to receive copies of your very fine publication.

It seems that each issue is an improvement over the last. Your stories are most interesting, your cuts are of the finest and the book is, all in all, a credit to the State.

Yours very truly,

(Signed) EDWARD M. FENNON,
Secretary.

Editor,
California Highways
and Public Works
Sacramento, California

Dear Mr. Howe:

We have forwarded our last copy of your publication "California Highways and Public Works" to Illinois.

We would appreciate your kindness in forwarding a copy to us for ur files, if it is possible for you to do so.

Yours very truly,

PACIFIC BRIDGE PAINTING CO.,
By A. Gerske

REQUESTED BY PWA

Care of Public Roads Admin.,
Crescent Mills, California.

California Highways and Public Works,
Sacramento, California.

Dear Sirs:

I have enjoyed reading, practically from its inception, intermittent issues of your excellent publication.

No longer being content to depend on borrowed copies, I am requesting that you

place me on your mailing list to insure that I'll miss no future issues.

Very truly yours,

(Signed) J. T. CASSELL,
Resident Engineer.

AIDS TRAFFIC RESEARCH

Editor California Highways
and Public Works,
Sacramento, California.

Dear Sir:

Since you kindly placed me on your mailing list the first of this year, I have read your current issues with deep interest and gained much information aidful in my traffic research and studies, and consider your publication a valuable addition to my reference file.

The recent article by Mr. S. V. Cortel-you, Highway Engineer, District VII, regarding "Freeways" and the "Arroyo Seco Parkway," was an especially interesting and informative one, as I am not only interested in this local improvement but have made a country-wide study on that subject.

Sincerely yours,

EDMUND C. EASTMAN,

Traffic and Transport Analyst,
Los Angeles, California.

FOR CHAMBER OF COMMERCE

Colusa Chamber of Commerce,
Colusa, California, May 3, 1940.

California State
Highway Department,
Public Works Building,
Sacramento, California.

Gentlemen:

Please mail us two copies of the last two issues of the Highway Magazine for the files of the Colusa Chamber of Commerce. We are particularly interested in the maps in them in reference to the Flood Control Situation.

Thanking you for this courtesy, we are

Yours truly,

A. B. DIVISON,
Colusa Chamber of Commerce.

Little Winnie had evidently been thinking hard as she sat on mother's knee before the fire. Presently she asked:

"Mother, why did you marry daddy?"

Mother looked at her sadly and sighed:

"So you've begun to wonder, too, have you?"

Change in Road Procedure Opposed By Western States Highway Officials

THE recent nineteenth annual convention of the Western Association of State Highway Officials attended by 112 official delegates representing all the western coast States, including Texas, adopted some resolutions having an important bearing on the disposition of federal funds received from the States from gasoline taxes and allocated to the States for highway construction.

One resolution vigorously opposes any change in the existing fundamental procedure, organization, and method of allocating funds and designating road systems and mileages. This resolution is in protest to a tendency on the part of other agencies to create a duplicating agency to carry on similar types of work.

The resolution also urged that federal funds for highway work be expended solely through the State highway departments and the Public Roads Administration.

WANT GAS TAXES RETURNED

Another resolution urges that all taxes collected from highway users by the federal government be returned to the States for systematic and coordinated highway construction through the State highway departments and the Public Roads Administration.

A third resolution urges that congress authorize federal funds for participation in State highway programs during the 1942 and 1943 fiscal years total not less than the 1938 and 1939 authorizations, pointing out that current federal aid authorizations expire at the end of the 1941 fiscal year.

RIGHTS OF WAY ISSUE

A resolution of supreme importance in long range highway planning foresees the pressing necessity for more adequate rights of way along highway alignments and aid in the acquisition thereof from the federal government.

Other resolutions recommend separation of forest highway funds from other forest road funds to eliminate unnecessary confusion and declared that in the future the Association

Resolution

Whereas, for the past 25 years, through cooperation between the state highway departments and the Public Roads Administration, there has been constructed in the United States a system of highways which is outstanding in the world; and

Whereas, from the funds allocated, the people of the nation now have a capital investment of at least 75 per cent of such funds which is still paying returns to them; and

Whereas, there is an apparent tendency on the part of other agencies to create a duplicating agency to carry on similar types of work; and

Whereas, through the cooperation of the state highway departments and the Public Roads Administration, basic data has been compiled which now is available to determine comprehensive state highway programs; and

Whereas, through the present cooperative arrangement there has been developed in the state highway departments and the Public Roads Administration a trained engineering personnel and organization competent to carry on highway building activities.

Now, therefore, be it resolved, that the Western Association of State Highway Officials representing the highway construction activities of the 12 western states does hereby vigorously oppose any change in the fundamental procedure, organization and methods of allocating funds and designating road systems and mileage; and

Be it further resolved, that it is the considered opinion of this association that any federal funds in the future to be used for highway construction should be expended through the state highway departments and the Public Roads Administration and no other federal agencies.

shall include, in addition to the eleven western States, the State of Texas.

Present at the convention were delegations from all member States, comprising Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington and Wyoming, as well as district and regional officials of the Public Roads Administration and W. C.

Markham, Executive Secretary of the American Association of State Highway Officials.

B. G. Dwyre, State Highway Engineer of New Mexico, was elected president, succeeding Robert A. Allen of Nevada. C. F. Seifried, Wyoming Highway Department Office Engineer, was elected vice president, and R. H. Flint, Idaho Highway Director was named secretary and treasurer.

Three new executive committee members named were: Mr. Allen; Preston G. Peterson, Utah Highway Commissioner and W. R. Hutchins, Arizona State Highway Engineer. The four holdover members are R. L. Bobbitt, Texas Highway Commissioner; Dr. L. I. Hewes, Regional Public Roads Administration, San Francisco; D. A. McKinnon, Montana Highway Engineer.

Highways Need More Federal Aid

(Continued from page 26)

based on an executed agreement between parties, to loan money on meritorious projects; and I do not see any danger in anyone abusing such authority. The only danger I can see is the possibility of not obtaining loans on reasonable terms.

The loans for the Reconstruction Finance Corporation are self-liquidating and repayments are made on a monthly, semiannual, or annual basis, or from resale of the bonds. This money is not lost forever but is repaid, which would then make it eligible for other projects.

I believe that where the Federal Government can loan money, as has been done through the Reconstruction Finance Corporation, if a State or municipality can obtain better terms through the Federal Government, they should take advantage of such loans. The Reconstruction Finance Corporation has ample facilities to pass on the liquidating features of an application.

Here in California, we do not contemplate going very far ahead of our construction program and our ability to finance construction.

Highway Bids and Awards for the Month of May, 1940

EL DORADO COUNTY—At Upper Truckee River about one mile west of Meyers, a reinforced concrete girder bridge to be constructed, about 0.3 mile of roadway to be graded and road-mix surface treatment applied. District III, Route 11, Section J. Scheumann & Johnson, Eureka, \$34,594; Holdener Construction Co., Sacramento, \$37,266; Harold Smith, St. Helena, \$37,294; Campbell Construction Co., Sacramento, \$37,298. Contract awarded to E. T. Lesure, Oakland, \$33,685.00.

FRESNO COUNTY—Between White Deer Road and Sequoia National Forest Boundary, about 3.1 miles to be graded and penetration oil treatment applied. District VI, Route 41, Section T. A. Teichert & Son, Inc., Sacramento, \$144,330; Hemstreet & Bell, Marysville, \$159,960; Piombo Bros. & Co., San Francisco, \$187,743; Guerin Bros., San Francisco, \$188,191; Johnston Rock Co., Inc., Stockton, \$190,426; A. S. Vinnell Co., Alhambra, \$192,069; Isbell Construction Co., Reno, \$194,127; Denni Investment Corp., Wilmington, \$207,129. Contract awarded to Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, \$137,755.

HUMBOLDT AND DEL NORTE COUNTIES—At various locations, about 23.8 miles road-mix surfacing and seal coat to be applied. District I, Route 1, Oranges Bros. Construction Department, Stockton, \$38,092. Contract awarded to Hayward Building Material Co., Hayward, \$37,410.25.

SOLANO COUNTY—Bridge across Sonoma Creek about 10 miles west of Vallejo, a portion to be redecked. District X, Route 208, Section A. Harold Smith, St. Helena, \$30,672; Campbell Construction Co., Sacramento, \$31,688; Albert H. Siemer and John Carcano, San Anselmo, \$32,742; E. E. Smith, Eureka, \$33,340; M. J. B. Construction Co., Stockton, \$36,421; Carl N. Swenson Co., San Jose, \$37,223; A. G. Raich, San Francisco, \$43,000. Contract awarded to Lee J. Immel, Berkeley, \$29,095.

IMPERIAL COUNTY—Stockpile pit run gravel in windrows on shoulders between Niland and County Line. District XI, Route 187, Sections F, G, R. E. Hazard & Sons, San Diego, \$5,440; Haines Canyon Materials Co., Glendale, \$3,984; A. L. Gabrielson, Arlington, \$5,680; A. E. Fowler & Sons, Santa Ana, \$5,840; E. L. Yeager, Riverside, \$5,600; A. S. Vinnell Co., Alhambra, \$5,192; M. McClelland, El Centro, \$4,800; F. J. Heidlebaugh, Long Beach, \$3,960; H. L. Miller, Hemet, \$6,320; Cozens & Hammond, Encinitas, \$5,840; A. C. Bussey, Riverside, \$7,840; Billings Truck Co., San Diego, \$9,840; V. R. Dennis Construction Co., San Diego, \$7,480. Contract awarded to Minnis & Moody, Los Angeles, \$3,600.

KERN COUNTY—Between 3.3 miles south of Poso Creek and Poso Creek, about 2.3 miles to be graded and road-mix surfacing applied. District VI, Route 129, Section A. Rexroth & Rexroth, Bakersfield, \$42,631; A. S. Vinnell Co., Alhambra, \$44,194; Louis Biasotti & Son, Stockton, \$45,709; Calowell Construction Co., Bakersfield, \$46,281; L. A. & R. S. Crow, Los Angeles, \$46,917; Guerin Bros., San Francisco, \$47,642; A. Teichert & Son, Inc., Sacramento, \$48,809; Claude C. Wood, Lodi, \$52,181; Dimmitt & Taylor, Los Angeles, \$55,713; Claude Fisher Co., Ltd., Los Angeles, \$57,124; Haines Canyon Materials Co., Glendale, \$57,142; L. C. Karstedt, Watsonville, \$58,443. Contract awarded to George E. France, Visalia, \$40,233.46.

LOS ANGELES COUNTY—Flashing light system to be installed about 1.9 miles

south of Newhall. District VII, Route 23, Sections H & I. Chandler Electric Co., Arcadia, \$848. Contract awarded to Moore Electric Co., Los Angeles, \$816.

LOS ANGELES COUNTY—Road-mix surface treatment over existing highway between W. Fork San Gabriel River and La Cienega. District VII, Route 62, Section B. Dimmitt & Taylor, Los Angeles, \$9,279. Contract awarded to A. S. Vinnell Co., Alhambra, \$7,739.

LOS ANGELES COUNTY—Over Arroyo Seco Channel at Avenue 60 Service Road, a rigid frame reinforced concrete box girder bridge to be constructed and roadway approaches to be graded and paved with portland cement concrete. District VII, Route 205, Section L.A. Oberg Bros., Los Angeles, \$18,863; J. S. Metzger & Son, Los Angeles, \$18,868; Contracting Engineers Co., Los Angeles, \$18,999; Carlo Bongiovanni, Hollywood, \$19,732; Wm. J. Distell, Los Angeles, \$20,050; Byerts & Dunn, Los Angeles, \$20,662; Baruch Corp., Los Angeles, \$22,654; John Higgins, Huntington Park, \$22,383; C. R. Butterfield & Kennedy Co., San Pedro, \$22,656; Geo. J. Bock Co., Los Angeles, \$22,726; Oscar Oberg, Los Angeles, \$23,217. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$18,270.

MARIPOSA COUNTY—Between Mariposa and 2 miles north, about 1.9 miles to be graded and surfaced with road-mix surface on gravel base. District X, Route 18, Section D. Louis Biasotti & Son, Stockton, \$86,790; A. S. Vinnell Co., Alhambra, \$90,387; A. Teichert & Son, Inc., Sacramento, \$92,248; Piombo Bros. & Co., San Francisco, \$97,615; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$91,944; M. J. B. Construction Co., Stockton, \$99,596. Contract awarded to Valley Construction Co., San Jose, \$78,231.

MENDOCINO AND LAKE COUNTIES—At various locations, about 32.1 miles road-mix surfacing and seal coat to be applied. District I, Routes 1, 15, 48. J. A. Casson Co., Hayward, \$75,140; Independent Construction Co., Ltd., Oakland, \$77,893; Oranges Bros. Construction Co., Stockton, \$79,457; E. A. Forde, San Anselmo, \$84,532; A. S. Vinnell Co., Alhambra, \$89,935; Marshall S. Hanrahan, Merced, \$92,494. Contract awarded to C. M. Syar, Yuba City, \$55,540.

MENDOCINO COUNTY—At Fox, Hearn and Schefer Gulches and at Pierson Draw, about 0.9 mile to be graded, blanketed with imported borrow and prime coat and seal coat applied thereto. District I, Route 56, Sections A, C. J. L. Conner and Sons, Point Arena, \$33,649; Guerin Bros., San Francisco, \$38,448. Contract awarded to John Burman & Sons, Eureka, \$32,563.

MENDOCINO COUNTY—Across Greenwood Creek about 19 miles north of Point Arena, an existing bridge to be repaired. District I, Route 56, Section C. F. Fredenburg, So. San Francisco, \$14,334; M. A. Jenkins, Sacramento, \$14,582; Fred J. Maurer & Son, Eureka, \$16,142; Harold Smith, St. Helena, \$16,513; James E. Anderson, Visalia, \$17,034; Albert H. Siemer and John Carcano, San Anselmo, \$17,084; R. G. Clifford, San Francisco, \$18,856. Contract awarded to Scheumann & Johnson, Eureka, \$13,416.

MONO COUNTY—Across West Walker River near Sonora Junction, a reinforced concrete box girder bridge to be constructed and approaches to be graded. District IX, Route 13, Section A. A. S. Vinnell Co., Alhambra, \$35,631; E. T. Lesure, Oakland, \$37,517; Valley Construction Co., San Jose,

\$43,281; Scheumann & Johnson, Eureka, \$44,312; Albert H. Siemer & John Carcano, San Anselmo, \$47,013. Contract awarded to Campbell Construction Co., Sacramento, \$35,341.

PLACER COUNTY—Between Grove Street in Tahoe City and three miles westerly, about 2.9 miles to be graded and surfaced with plant-mixed surfacing on gravel base. District III, Routes 33 and 38, Sections A & B. Piazza and Huntley, San Jose, \$72,889; Louis Biasotti & Son, Stockton, \$79,305; Marshall S. Hanrahan, Redwood City, \$128,422. Contract awarded to Independent Construction Co., Ltd., Oakland, \$68,813.

PLACER AND NEVADA COUNTIES—Between Hampshire Rocks and Soda Springs about 5.5 miles portions of roadway to be graded and the project to be surfaced with crusher run base and plant-mixed surfacing. District III, Route 37, Sections F.B. Independent Construction Co., Ltd., Oakland, \$83,245; Piazza & Huntley, San Jose, \$86,544; Marshall S. Hanrahan, Merced, \$106,151. Contract awarded to J. R. Reeves, Sacramento, \$66,172.

SAN JOAQUIN COUNTY—Walkway constructed on Mossdale Bridge. District X, Route 5, Section B. Pomeroy Sinnock, Stockton, \$11,997; C. C. Gildersleeve, Berkeley, \$11,399. Contract awarded to F. Kaus, Stockton, \$9,744.

SANTA BARBARA COUNTY—Between Jonata Park and Zaca, about 2.7 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District V, Route 2, Section D. A. Teichert & Son, Inc., Sacramento, \$137,337; Denni Investment Corp., Wilmington, \$145,675; Clarence Crow, Los Angeles, \$148,413; Louis Biasotti & Son, & L. D. Tonn, Stockton, \$149,931; Daley Corp., San Diego, \$154,290; Heafey-Moore Co., Oakland, \$156,610. Contract awarded to Guerin Bros., San Francisco, \$131,932.

SISKIYOU COUNTY—Existing bridge across Klamath River about 26 miles northeast of Orleans to be redecked. District I, Route 46, Section A. Fred J. Maurer & Son, Eureka, \$8,153; Fred Fredenburg, So. San Francisco, \$9,985; Scheumann & Johnson, Eureka, \$8,222; C. C. Gildersleeve, Berkeley, \$9,299. Contract awarded to E. E. Smith, Eureka, \$7,621.

SOLANO COUNTY—Under the tracks of the Southern Pacific Co. about 0.7 mile south of Davis, an underpass consisting of a through steel girder deck on concrete piers and abutments to be constructed. District X, Route 6, Section A. Campbell Construction Co., Sacramento, \$178,196; E. E. Smith, Eureka, \$183,455; Earl W. Heple, San Jose, \$187,030; Engineers, Ltd., Sacramento, \$188,780; United Concrete Pipe Corp., Los Angeles, \$189,236; A. Soda & Son, Oakland, \$191,558. Contract awarded to Heafey-Moore Co., Fredrickson & Watson Const. Co., Oakland, \$175,903.

RIVERSIDE COUNTY—Existing bridge to be repaired by extending 7 bents with steel piles and reinforced concrete about five miles west of Indio. District XI, Route 64, Section Q. R. J. Daum, Inglewood, \$7,714; Valley Construction Co., San Jose, \$8,343; A. S. Vinnell Co., Alhambra, \$7,435; J. E. Anderson, Visalia, \$6,489; T. B. Penick & Sons, San Diego, \$8,863. Contract awarded to Thomas Construction Co., Burbank, \$6,025.

RIVERSIDE COUNTY—Between Ranning and junction Route 187, about 11 miles to be graded and surfaced with plant-mixed

(Continued on page 32)

Cement Experiments Through the Ages

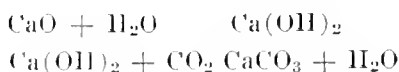
By LESTER C. MEDER, Assistant Physical Testing Engineer

The following is the third and concluding installment of a paper upon the history and manufacturing of Portland cement. The first two parts briefly summarized the history of cement, the winning and preparation of the raw materials, and the burning and cooling of the clinker.

UNTIL comparatively recently it was thought that, to be sound, cement should be made from a clinker exposed to the weather for several months. More recent research, however, has developed that one of the principal causes of unsoundness may be the presence of "free" or uncombined lime, an indication that the burning processes in the kiln had been incomplete.

Many current specifications frown upon the practice of aging clinker, one actually requiring that the clinker be ground within six weeks of its manufacture and further specifying that it shall be kept covered and dry until ground. Other specifications attempt to control this feature by limiting the allowable "free" lime in the clinker.

Volume change or unsoundness is caused by the presence of a dead-burned, uncombined lime or calcium oxide in a state that hydrates very slowly. This calcium oxide in the presence of moisture forms hydrated lime, which in turn is converted to calcium carbonate in the presence of carbon dioxide in the air, or:



If these reactions take place while the cement is still in the clinker stage, no serious harm may be done, though the cement would be of a definitely inferior quality. However, if the changes take place after the cement has been made into concrete, sufficient expansive forces may be set up to rupture the concrete.

As soon as the clinker has cooled it is ready for grinding. In some mills it is first passed rapidly through rolls or some preliminary crushers where it is reduced to the fineness of coarse sand. In other plants this preliminary reduction is eliminated and the kiln run clinker is fed directly into the tube mills.

The tube mill is a hollow, heavy steel cylinder from 5 to 10 feet in diameter and up to 60 feet long, supported by heavy, hollow steel trunnions or shafts on each end. It revolves at a speed of approximately 20 revolutions per minute, the speed depending upon the radius of the mill and the specific gravity of the grinding media, being somewhat faster for smaller

mills and slower for the larger mills. The tube is nearly half full of rounded steel slugs. The clinker is crushed and the grinding accomplished by the falling slugs as the tube revolves.

At the ideal speed the slugs describe the greatest and most effective drop. At slower speeds they roll ineffectively down the side after exceeding the angle of repose, whereas at speeds above the ideal, they are carried too far and on falling strike the opposite side of the mill at an ineffective angle. At still greater speeds, centrifugal force holds the slugs against the side of the tube so that they do not fall at all.

Grinding in tube mills is effected almost entirely by percussive or shock; attrition, or rubbing being reduced as much as possible. The rotation of the mill at proper speed carries the slugs around to a point where gravity overcomes the centrifugal force and the slugs fall onto the cement clinker in the bottom of the tube. It is this continuous action, and impact of the slugs that reduces the cement clinker to an impalpable powder.

Formerly, round flint pebbles were

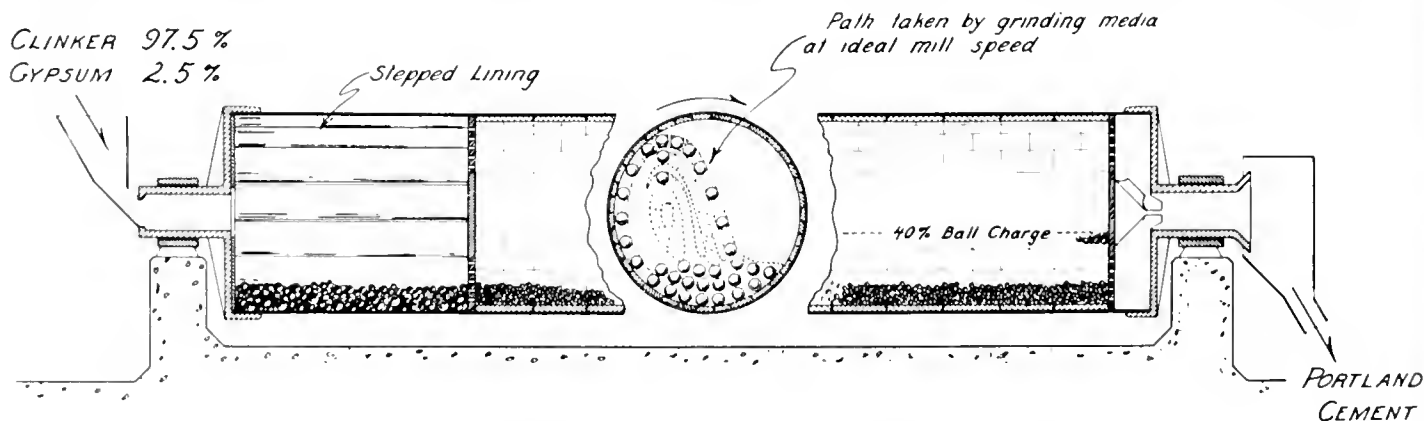


Fig 3 - Section of Compound Mill used for grinding Cement Clinker. 20% Ball Charge Shown. Charges up to 40% often used

used as a grinding media. These were imported in great quantities from England, France and western Europe where flint nodules occur in extensive chalk deposits. The nodules are set free by wave action along the coast and are then rounded in the surf. In this country, though there are many flint formations, none of them outcrop near a shore, and therefore only rough angular rocks unsuitable for grinding are available. One of the northern California mills at one time obtained its pebbles from the gravel deposits near the American River. In grinding, these local pebbles wore down about twice as fast as the imported pebbles, but as they cost less than half as much, the greater wear was more than compensated by the lower cost. Of recent years steel slugs have almost entirely replaced flint as a grinding media, except in cases where pollution by iron must be avoided. These steel slugs are in various shapes; spheres, tetrahedrons, short and long cylinders, springs, cones, being some of the more ordinary shapes. They vary from 3 inches to $\frac{3}{4}$ inches in size, and from 4 pounds to .06 pounds in weight.

Since 1920 there has been a definite trend toward the use of larger grinding mills and compound mills or mills with more than one compartment. Figure 3 shows a typical two compartment mill. Some mills in use have three or more compartments. The compound mill tends to eliminate the preliminary crushing of the clinker. The first compartment (fig. 3) which carries the larger slugs is lined with chrome steel stepped plates, while the second or longer compartment carries the smaller slugs and is lined with a smooth surface of white cast iron or wear-resisting steel.

The clinker is fed into the charge end of the tube mill at a measured rate, and a definite percentage (2.5%-3.0%) of gypsum is added at this point. As this mixture flows into the path of the falling slugs, it is shattered and rapidly reduced to a coarse powder, the coarse powder then passes out of the first compartment and into the next where finish grinding is accomplished by small balls. As the material passes on toward the outlet, or discharge end, it becomes finer and finer until it is discharged as an impalpable powder.

There are three types of grinding in general use at the present time: (1) "open circuit," (2) "closed circuit," and (3) "windswept." When

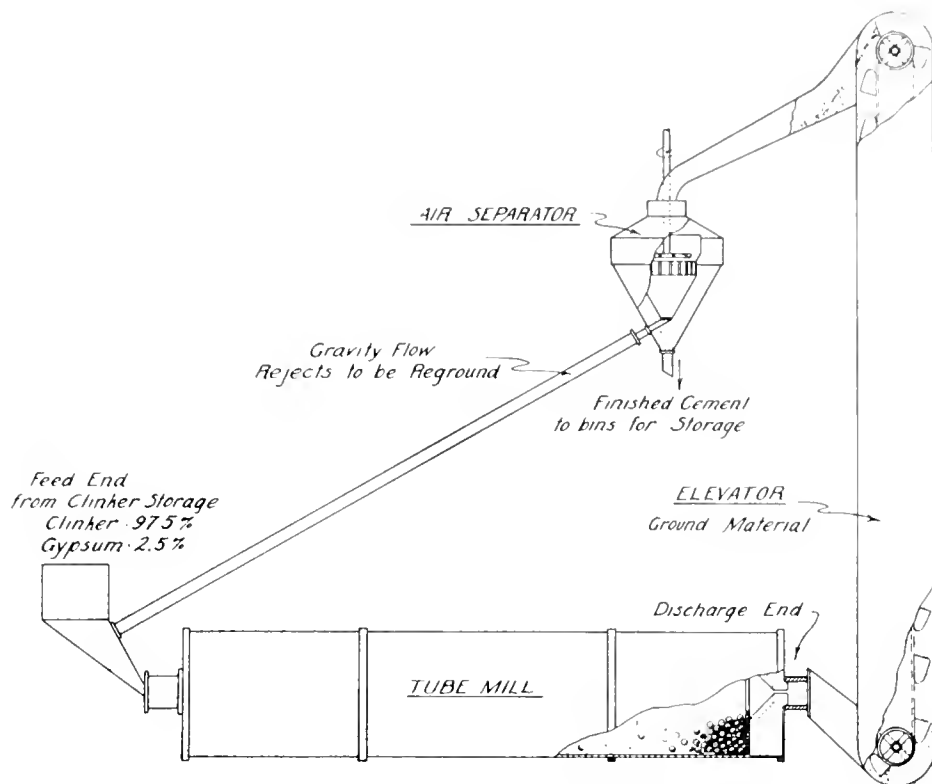


FIG 4 - Flow Sheet for Finish Grinding Process

grinding in "open circuit," the clinker enters the mill, passes through, and emerges as a finished cement, the complete grinding process being accomplished in one passage through the mill. When discharged, it is conveyed to the storage bins. In "closed circuit" grinding, the cement is passed through the mill at a much higher rate, made possible by the use of larger balls. When the cement leaves the tube mill, only a fraction is as fine as desired. It is then lifted in an elevator to an air separator where a strong draft of air separates out the finer material which is the finished product, and conveys it to the storage bins. The coarser material, or rejects are returned to the feed end of the tube mill to be reground. The flow sheet for this process is shown in Figure 4. In a typical set up, a mill might have a circulating load of 350%. This means that 450 pounds of material, of which 100 pounds is fresh clinker and 350 pounds of rejects from the air separator are fed in to the mill. Of this combined charge 100 pounds will be completely ground to a finished product, and 350 pounds will be returned to the system as rejects. Under such conditions, the average particles will pass through the mill three or four times

before being reduced to the desired size. In the third type, or the "windswept" mill, a draft of air is passed constantly through the tube mill. As soon as a cement particle is small enough, it is swept out of the mill as the finished product. The last two types of grinding are now in universal use because they increase the efficiency of a mill by reducing the amount of very fine flour in the mill which would only serve to cushion the blows and thereby reduce the grinding efficiency.

The rate of grinding is a function of the fineness of the finished product, and is controlled by the rate the clinker is added to the mill. To give an idea of relative speeds, a mill that produces 60 barrels of cement per hour with a surface area of 1600 square centimeters per gram would produce only about 20 barrels if the surface area were increased to 2100.

The size of the balls used in grinding is determined by the size of the material to be ground. They should be large enough to completely shatter a piece of clinker. Greater efficiency is developed using smaller balls if they qualify under the first requirement. For equal total weights, one charge with balls weighing five

(Continued on page 32)

Redecking the Yolo Causeway

(Continued from page 16)

width of 42 feet with a 3-foot sidewalk. The full width of the roadway was surfaced with an asphaltic concrete pavement.

The Sacramento River Flood Control Project contemplates the construction of the levee near the west end of the causeway at some time in the future. The proposed levee height would necessitate the raising of the grade of the causeway approximately 8 feet for a distance of 1,200 feet at the westerly end.

Because of the indeterminate date of future levee work as well as lack of sufficient funds, it was decided to reconstruct the twenty-four-year-old timber portion of the structure on the existing grade by means of a standard timber deck with a concrete slab wearing surface. The concrete slab is designed with a timber deck so that it can be jacked up to ultimate grade whenever the west levee is constructed, without any loss of the present investment.

On January 25, 1940, a contract was awarded to redeck the original timber trestle. This work consisted of removing the existing rail and asphalt concrete surfacing of 2,470 feet of trestle. The existing caps, stringers, and subflooring were removed and new caps, stringers, and 1-inch subfloor were placed on 2,337 feet of the causeway. The existing subflooring remained in place on 133 feet. All contact surfaces were treated with two coats of wood preservative before the timbers were placed.

The reinforced concrete pavement was poured in two lanes by means of transit mixed concrete. The north traffic lane, 10 feet in width was poured first followed by the pouring of the south lane, 11 feet in width. A longitudinal construction joint was formed between lanes and the steel was lapped at this joint to provide a 40 diameter lap of the reinforcing steel.

The slabs were finished with a mechanical paving machine supplemented by 8 foot airplane floats. The deck was given a broom finish to provide a non-skid surface.

To avoid cracking of the partially poured concrete over the transverse reinforcing steel caused by vibration

Bids and Awards

(Continued from page 29)

surfacing on cement stabilized base. District VIII, Route 26, Section Ban., C. Heafey-Moore Co., Frederickson & Watson Construction Co., Oakland, \$376,444; Griffith Co., Los Angeles, \$375,861; Warren Southwest, Inc., Los Angeles, \$375,861; Baisch Bros., Torrance, \$376,499; Daley Bros., San Diego, \$378,653; Oswald Bros., Los Angeles, \$379,681; Fredrickson & Westbrook, Sacramento, \$379,947; A. Teichert & Son, Inc., Sacramento, \$386,584; United Concrete Pipe Corp., Los Angeles, \$390,731; Matich Bros., Elsinore, \$393,155; J. E. Haddock, Ltd., Pasadena, \$414,314; Claude Fisher Co., Ltd., Los Angeles, \$435,434. Contract awarded to Geo. Herz & Co., San Bernardino, \$367,305.

SAN MATEO COUNTY—Across Pescadero Creek about 20 miles south of Half Moon Bay and across San Gregorio Creek about 13 miles south of Half Moon Bay, two reinforced concrete girder bridges to be constructed. District IV, Route 56, Section B. E. T. Lesure, Oakland, \$91,515; Scheumann & Johnson, Eureka, \$91,865; Harry J. Oser, San Francisco, \$94,935; A. Soda & Son, Oakland, \$95,539; Fred J. Muner & Son, Eureka, \$97,592; E. E. Smith, Eureka, \$103,284; R. G. Clifford, San Francisco, \$109,105. Contract awarded to Campbell Construction Co., Sacramento, \$82,964.04.

VENTURA COUNTY—At the Fillmore Maintenance Station Site, a water supply well to be drilled. Contract awarded to Leonard A. Anderson, Camarillo, \$790.

set up by fast moving vehicles on the adjacent traffic lane, it was necessary to place one-way traffic control with a pilot car. Such traffic control is maintained until the concrete has been allowed to set for approximately 12 hours. Upon the completion of this contract, traffic will be confined to the two lanes on the north half of the structure.

Another contract was awarded on April 20, 1940, to repave the entire south half of the structure, a length of 3.13 miles, with a 4-inch reinforced concrete pavement. It provides for the removal and disposal of the existing asphaltic concrete surfacing on the south half, the construction of a light weight concrete deck on the bascule span, and the feathering out of asphalt concrete surfacing on the north half of the structure for a distance of 14,068 feet. The paving of the south half also will be performed with standard paving equipment.

Both contracts, which have been awarded to Lee J. Immel, are being prosecuted simultaneously. It is anticipated that the redecking will be completed and the causeway thrown open to four lanes of traffic by September 1. The total cost of the work involved in both contracts is approximately \$203,000.

Cement Experiments Through the Ages

(Continued from page 31)

pounds each and the other with balls weighing only one pound, there would be five times as many separate blows per revolution of the mill with the lighter than with the heavier balls.

With the demand for finer ground cements, the grinding problem has become more and more complicated. Efficient grinding requires that certain conditions be met, and in order to meet them, there is a growing demand for grinding aids, and improved grinding methods. The use of dispersing agents or grinding aids, unless they are proven by use, may lead to an inferior grade of cement and for that reason, they are closely watched.

For maximum efficiency the following conditions must be met:

1. The balls must be kept clean so that the impact is at a maximum.
2. The cement particles must be kept from agglomerating, or sticking together.
3. The mill temperature must be kept below 300°-350° F. to keep the gypsum from being altered.

After the completion of the grinding process, the cement is conveyed in steel pipes with compressed air into the bins where it is stored until used.

Up to comparatively recent years cement was handled entirely in sacks, but with the tremendous quantities now being used in relatively small areas, such as for the piers of the San Francisco-Oakland Bay Bridge, the Boulder and other dams, more and more cement is being shipped in bulk, both by railroad and by truck. Packing the cement in sacks is one of the interesting sights in a plant.

The sacks, which have a flap valve in the bottom, are first tied automatically, and then slipped on a hollow tube. The cement, flowing through this tube fills the sack to 94 pounds, at which weight the flow is automatically stopped. Ninety-four pounds is the weight of one cubic foot of cement. The filled sack then drops on a belt conveyor to be loaded into cars on trucks.

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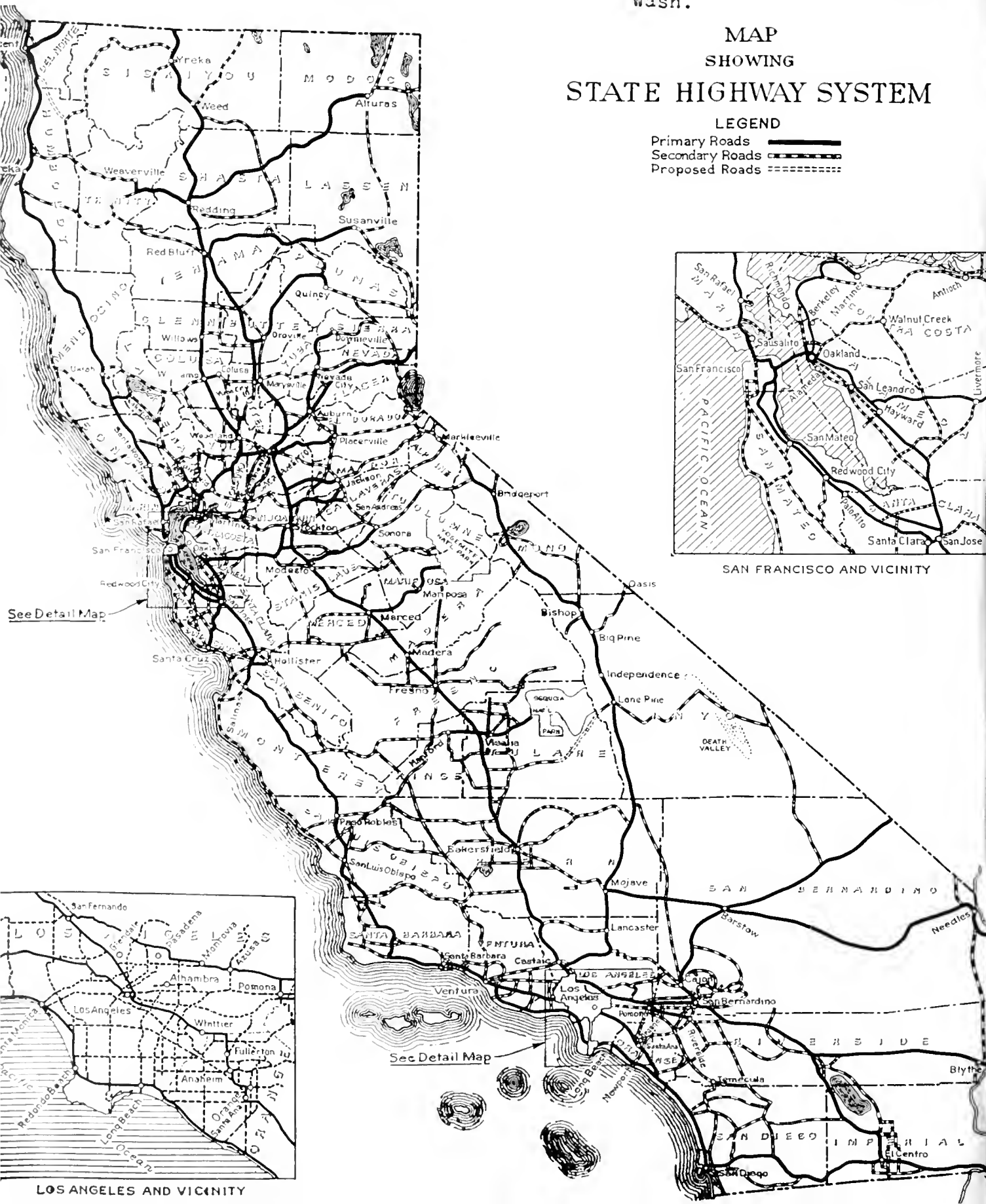
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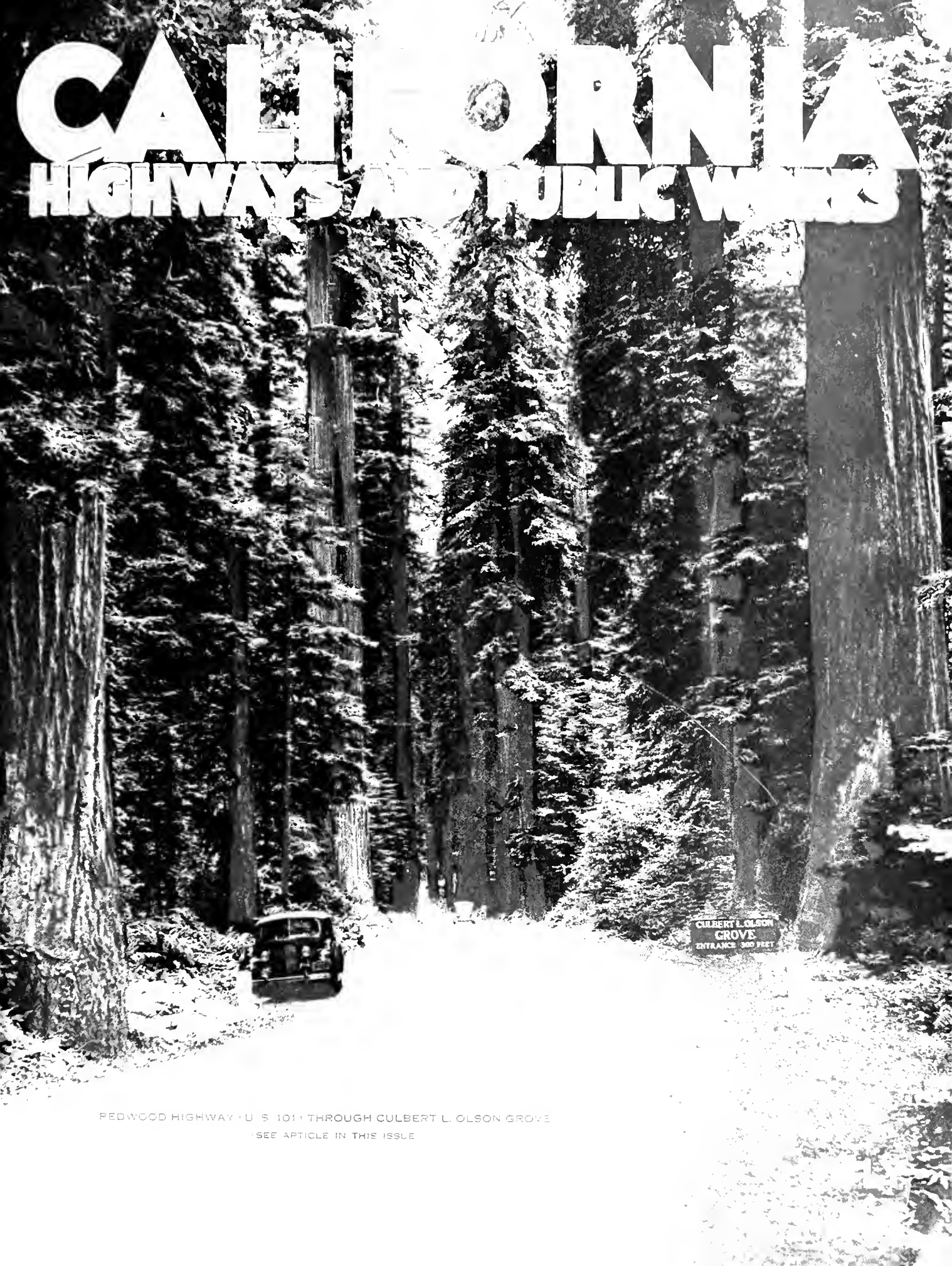
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CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



PEDWOOD HIGHWAY (U.S. 101) THROUGH CULBERT L. OLSON GROVE

(SEE ARTICLE IN THIS ISSUE)

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California

FRANK W. CLARK, Director

C. H. PURCELL, State Highway Engineer

J. W. HOWE, Editor

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JULY, 1940

No. 7

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\$24,978,841 Gasoline Tax Funds Allocated to Cities and Counties for Year Ended June 30, 1940

APPORTIONMENT of gasoline tax revenues available for counties, cities, and the State Division of Highways during the fiscal year ending June 30, 1940, have been completed in accordance with the provisions of section 13 of the Motor Vehicle Fuel License Tax Act. The total apportioned to counties and cities during the year amounted to \$24,978,841.82.

Total collections during the year amounted to \$54,663,653.53 which, after refunds of \$4,515,915.57 and expenses of the State Controller and Board of Equalization amounting to \$190,054.31, left \$49,957,683.65 available for apportionment.

Of the above amount available for apportionment the counties received one-third, or \$16,652,561.22. The apportionment to counties is determined in the following manner:

1. Each county first receives a minimum of \$7,500.
2. The remainder is apportioned to the counties in the proportion that the registration of vehicles in each of such counties bears to the total vehicles registered in the State.

After apportionment to the counties the remaining two thirds, in this case \$33,305,122.43, is paid into the State highway fund to be expended as the act says, "in accordance with law for the payment of all necessary charges incurred in carrying out the provisions of the Streets and Highways Code, and of any other law relating to the acquisition of real property for and the construction, maintenance or improvement of highways."

Section 194 of the Streets and Highways Code requires that the net revenue from one quarter cent per gallon of tax or one eighth of the amount paid into the State highway fund be expended for the construction, improvement or maintenance of city streets of major importance other than State highways. The apportion-

Increase of Federal Gasoline Tax Rate

Under laws passed by Congress providing for national defense, Federal gasoline taxes have been increased by one-half a cent and the additional tax became effective July 1.

Prior to that date, the Federal tax on gasoline was one cent per gallon and it has thereby been increased to one and one-half cents per gallon.

The Federal tax on oil was four cents per gallon, or one cent per quart prior to July 1, 1940, and four and one-half cents per gallon or one and one-eighth cents per quart thereafter.

The State tax on gasoline remains at three cents per gallon, and the increase of the Federal tax will not affect the State income from this source unless the additional one-half cent Federal tax results in a decrease in gasoline consumption by the motoring public or an increase in the sale price of gasoline by the producers.

ment to the various cities of the State is made on the basis of population as determined by the last Federal census.

Section 203 of the Streets and Highways Code requires the expendi-

ture of another one-quarter cent of net revenue on State highway routes within cities. This apportionment to the several cities is also made on a population basis.

These apportionments are based on the old 1930 Federal census. Official 1940 census figures are not expected to be available for use prior to the January, 1941, apportionment.

With a fixed amount of gasoline tax and "in lien" tax funds available for apportionment among the 285 incorporated cities in the State, the increase over the 1930 census will result in a smaller per capita apportionment. It is quite probable that some cities, even though they have an increase in population, will receive less apportionment than formerly if their percentage increase is less than the average increase in population of all the cities in the State.

Municipal population in California, according to the 1930 census, was 4,304,590. For 1940, it is estimated that it will probably exceed 4,500,000.

The gasoline tax revenues described above are for the three-cent tax levied by the State and does not, of course, include the one-cent tax levied by the Federal government up to July 1, 1940.

In the following tabulations are shown:

1. Apportionments to the counties amounting to \$16,652,561.22 made during the fiscal year from the 3-cent gasoline tax collected by the State.

2. Apportionments to the cities of one-quarter cent funds for city streets and State highways within cities for the fiscal year amounting to \$8,326,280.60, making in all.

3. A grand total of \$24,978,841.82 of gasoline tax funds apportioned to cities and counties during the past fiscal year.



View of Cahuenga Freeway looking southeasterly, showing underpass beneath Pacific Electric tracks at intersection of Highland and Cahuenga avenues.

Cahuenga Freeway Unit Opened

By S. V. CORTELYOU, District Engineer

SIGNALIZING an important step in the program which contemplates the eventual elimination of a "bottleneck" condition which has existed in historic Cahuenga Pass in Los Angeles County for three decades, the first section of the Cahuenga Pass Freeway, State Highway Route No. 2, was officially opened to public traffic on June 15, 1940.

This project was a cooperative one participated in by the Federal government, the State and the city of Los Angeles. Therefore, it was highly appropriate that on behalf of the State and the Federal government, sponsors of practically all of the funds expended on this new highway, Governor Culbert L. Olson and Re-

gional Director K. A. Godwin of the Public Works Administration, should join with Mayor Fletcher Bowron of Los Angeles and other public officials and civic leaders in dedicatory ceremonies attendant upon the formal opening of Cahuenga Pass Freeway.

Celebration of the opening of the new link in the State Highway System was arranged for by the Hollywood Chamber of Commerce, as was the luncheon at the Hollywood Bowl which followed. At the luncheon, Highway Commissioner Amerigo Bozzani of Los Angeles expressed the regrets of Director of Public Works Frank W. Clark over his inability to be present, due to official business which required his presence in the north.

With the dedication of Cahuenga Pass Highway there was made available for the public the first unit of one of the most beneficial highway projects ever undertaken in the Los Angeles metropolitan area.

Since Los Angeles was a small pueblo, Cahuenga Pass has been a main artery of traffic. Being the only pass through the Hollywood hills, which separate the San Fernando Valley and the coastal plain, it was only natural that the first trails and wagon roads running northwesterly from Los Angeles should traverse this pass.

When automobiles began to come into general use, travel over this route increased rapidly. With the astonishingly rapid growth of Holly-



Views of Cahuenga Freeway with 8 traffic lanes divided by Pacific Electric tracks. At top—looking north from Cahuenga-Highland intersection showing Pilgrimage Play bridge in background and subway underpass to Cahuenga Avenue. At bottom—looking north from Pilgrimage Bridge. Note entrances to service roads on right and left with intersectional islands.



Group at dedication ceremony of Cahuenga Pass Freeway. Left to right: Tom Keene, honorary mayor of Sherman Oaks; Governor Culbert L. Olson; John B. Kingsley, President of Hollywood Chamber of Commerce; Mayor Bowron of Los Angeles; Gene Autrey, honorary mayor of North Hollywood; Mayor F. C. Tilson of Burbank and Richard Arlen, honorary mayor of Sunland. The man whose head appears between Mr. Kingsley and Mayor Bowron is State Highway Commissioner Amerigo Bozzani.

wood and western Los Angeles the volume of traffic increased to the point where Cahuenga Pass became one of the most troublesome "bottle-necks" in Southern California.

The original two-lane pavement laid through the pass was very soon found to be inadequate and was widened and otherwise improved in successive stages until a four-lane pavement with a parking strip on each side was provided. But in the meantime traffic increased more rapidly than highway facilities and almost daily during the peak hours traffic was seriously delayed and traffic accidents became more frequent. Streets and interurban railways intersecting at grade with consequent large turning movements created an additional traffic problem which was extremely difficult to solve.

In the meantime, the "Freeway" idea was taking definite form as a means of converting our main metropolitan highways into thoroughfares free from traffic interference and delays. This suggested itself as the solution of the Cahuenga Pass traffic problem.

Tentative plans were proposed by City Engineer Lloyd Aldrich of Los Angeles for a freeway to extend from the intersection of Cahuenga and

Highland Avenue in Hollywood north-erly through the pass for approximately three miles to Vineland Avenue and Ventura Boulevard as a part of the Hollywood Parkway Project from downtown Los Angeles to San Fernando Valley through Cahuenga Pass.

State Highway engineers cooperated with the city in the plans for the work and recommended to Director of Public Works Clark and the California Highway Commission that the State finance the sponsor share of a Public Works Administration project to carry out the construction of this freeway.

EIGHT 12-FOOT LANES

The San Fernando Valley line of the Pacific Electric Railway was located through Cahuenga Pass many years ago and plans for the Freeway provided for relocating the railroad and using it as a central dividing strip between opposing lines of vehicular traffic.

The main Cahuenga Boulevard traffic will be carried on eight twelve-foot traffic lanes—four being for inbound and four lanes for out-bound traffic. These are of heavy

concrete construction designed to carry the largest legal truck loads. Thirty-foot service roads will handle local traffic on the outside of the main "freeway" lanes with channelized connections to the "Freeway" at convenient locations.

A comprehensive dividing plan has been worked out for the intersection of Cahuenga Boulevard and Highland Avenue. Incoming traffic wishing to continue along Highland keeps in the right-hand two lanes. The two left-hand lanes curve to the left and pass under the Pacific Electric tracks into Cahuenga Boulevard in Hollywood. Similarly, outbound traffic on Highland Avenue has the choice of turning right on Cahuenga or continuing through the pass without traffic interference.

BRIDGE TO SERVICE ROADS

The Pilgrimage Play Bridge crosses the railroad and "freeway" to connect service roads on each side of the freeway. A short distance to the north of the Pilgrimage Play Bridge, the Mulholland Highway Bridge crosses over the freeway and railroad.

Actual construction was started

(Continued on page 17)

Automobile Toll Cut to 25 Cents on San Francisco-Oakland Bay Bridge

THE goal of a 25 cent passenger automobile toll on the San Francisco-Oakland Bay Bridge, which was set by Governor Culbert L. Olson and Director of Public Works Frank W. Clark, was attained on June 24, when the California Toll Bridge Authority, meeting in Sacramento, adopted a new schedule of bridge charges, effective July 1, which constituted the fourth reduction in tolls within twelve months.

In a written report to the Governor Director Clark said that increased Bay Bridge traffic developed as a result of the abandonment of service by the Southern Pacific Golden Gate ferries on May 16 fully warranted this additional toll reduction.

REVENUES SUFFICIENT TO MEET PAYMENTS

The report stated that with the vehicular toll reduced to a 25 cent base on July 1, the calculated bridge revenue for the twelve-month period July 1, 1940, to June 30, 1941, would be sufficient to more than care for required disbursements such as interest payments, minimum reserve fund payments and other costs. Estimated revenues for the year beginning July 1 are as follows:

Revenue from vehicular traffic.....	\$3,351,605
Revenue from bridge railway passengers.....	497,005
Revenue from rents, accrued interest, etc.....	86,699
Total calculated revenue.....	\$3,935,309

During the same period, Director Clark's report said, earnings required in accordance with the Bond Resolution would amount to \$3,804,290, leaving an indicated excess of calculated earnings over requirements of \$131,019.

The new 25 cent toll applies to automobiles, ambulances, hearses, taxis, light delivery automobiles and trailers drawn by automobiles. The charge for tri-cars is reduced from 25 cents to 20 cents, and proportionate reductions have been ordered for trucks and truck-trailers, vehicles requiring special permits per ton gross weight and for vehicles not otherwise specified.

COMMUTATION RATES ALSO REDUCED

Commutation books for passenger automobiles containing from 50 to 54 one-way trip tickets were reduced from \$10.75 to \$10.00 and commutation books for passenger automobiles containing 40 one-way tickets good for the calendar month were reduced from \$9 to \$8.

In announcing the new tolls, Director Clark said, "It has been our determination since Governor Olson assumed office to bring the vehicular toll on the Bay Bridge down to a 25 cent basis. As Chairman of the Toll Bridge Authority, the Governor has succeeded in making three toll reductions to date, the first on June 15, 1939, from 50 cents to 40 cents; the second on January 1, 1940, from 40 cents to 35 cents, and the third on May 25, 1940, from 35 cents to 30 cents."

Effective July 1, 1940					
Class	Vehicle	New Rate	Old Rate		
1—Automobiles, ambulances, hearses, taxis, light delivery automobiles.....		\$0.25	\$0.30	9—Vehicles not otherwise specified:	
2—Trailers drawn by automobiles.....		.25	.30	Per ton gross weight.....	\$0.15 \$0.175
3—Trucks and truck trailers, including any load:				Minimum charge.....	.40 .50
Gross weight up to 20,000 lbs., per ton, at.....		.15	.175	The following monthly commutation rates are prescribed.	
Additional gross weight from 20,000 lbs. to 40,000 lbs., per ton, at.....		.10	.15	10—Commutation—For passenger automobiles only.	
Additional gross weight over 40,000 lbs., per ton, at.....		.05	.125	Book to contain from 50 to 54 one-way trip tickets (depending on length of calendar month) good for the calendar month.....	10.00 10.75
Minimum charge.....		.40	.50	In addition the book will contain twenty (20) provisional tickets, each good for a one-way trip upon presentation and payment of twenty cents (20¢), provided all regular tickets have been used. Additional provisional tickets for the same calendar month will be issued upon surrender of the complete empty cover—front and back—of a \$10.00 commutation book of the same month.	
4—Local Key System buses, per passenger carried		.025	.025	11—Commutation—For passenger automobiles only.	
5—Other buses				Book to contain 40 one-way trip tickets, good for the calendar month.....	8.00 9.00
a. (To remain in effect until rate 5b below is ordered)				In addition the book will contain ten (10) provisional tickets, each good for a one-way trip upon presentation and payment of twenty cents (20¢), provided all regular tickets have been used. Provisional tickets in excess of the above will not be issued to purchasers of this book.	
Bus with driver.....		.75	.75		
Passengers in excess of driver..... each		.05	.05		
b. (To be made effective on order of the Director of Public Works)					
Bus with driver and passengers.....		1.00	1.00		
6—Motorcycles.....		.15	.15		
7—Tricars.....		.20	.25		
8—Vehicles requiring special permit:					
Per ton gross weight*.....		.15	.20		
Minimum charge*.....		1.00	1.00		

* Vehicles exceeding limits of special permit to be assessed double this toll.

Super-Highway on Viaduct to Break San Rafael Bottleneck

By F. W. PANHORST, Bridge Engineer

A CONGESTED traffic situation now prevails in the city of San Rafael. Since the opening of the Golden Gate Bridge traffic has increased in volume and its free and uninterrupted flow has been blocked.

Traffic counts taken in July, 1939, show 21,562 vehicles on Sunday and 12,538 on Monday near the south city limits. At the north city limits the counts are 19,441 and 10,298, respectively for Sunday and Monday. These counts indicate an average daily traffic of approximately 13,500 vehicles.

This represents the traffic count of vehicles passing through the city and not necessarily the cross traffic and that moving within the city itself. The pressure of this heavy traffic, which is dumped at the city boundary and forced to find its way through the narrow, tortuous section of the city, operates as a "bottleneck."

Congestion is not caused entirely by the number of vehicles using the

street but by the speed with which vehicles can move along it. Widening the street through this already crowded district would probably only increase the difficulty, as it would be necessary to take care of contiguous property by parallel service roads with numerous connections and cross streets. Subsequent improvements would invite more "on and off" movement and thus create more congestion, delay and hazard.

Consideration of a ground level design to alleviate the situation presented serious obstacles. The route through the southern portion of the city crosses a number of city streets at right angles over which traffic moves between the east and west parts of town. Through traffic would thus be presented with a serious delay by local cross traffic.

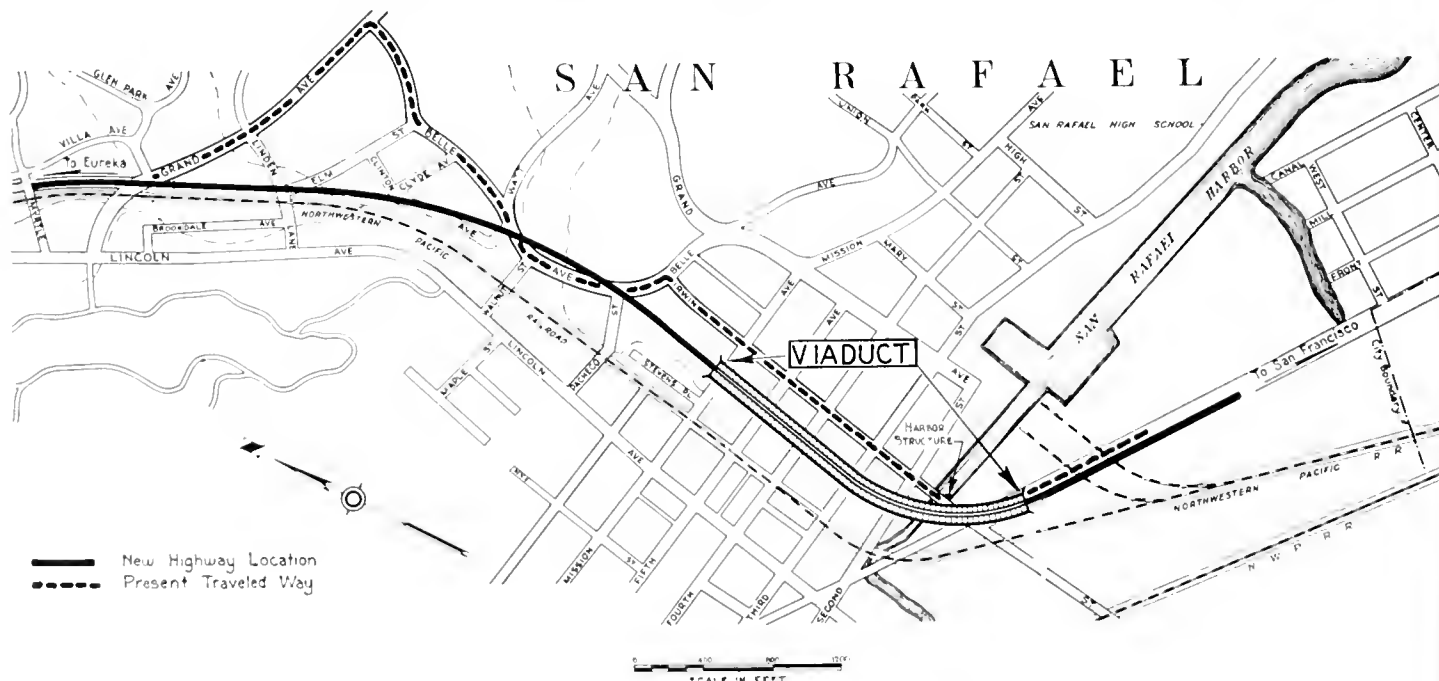
Traffic signals would only add to the delay and congestion. The significant point is that 75 per cent of the Redwood Highway traffic reaching San Rafael passes on through the

city. It therefore must be given dominant consideration.

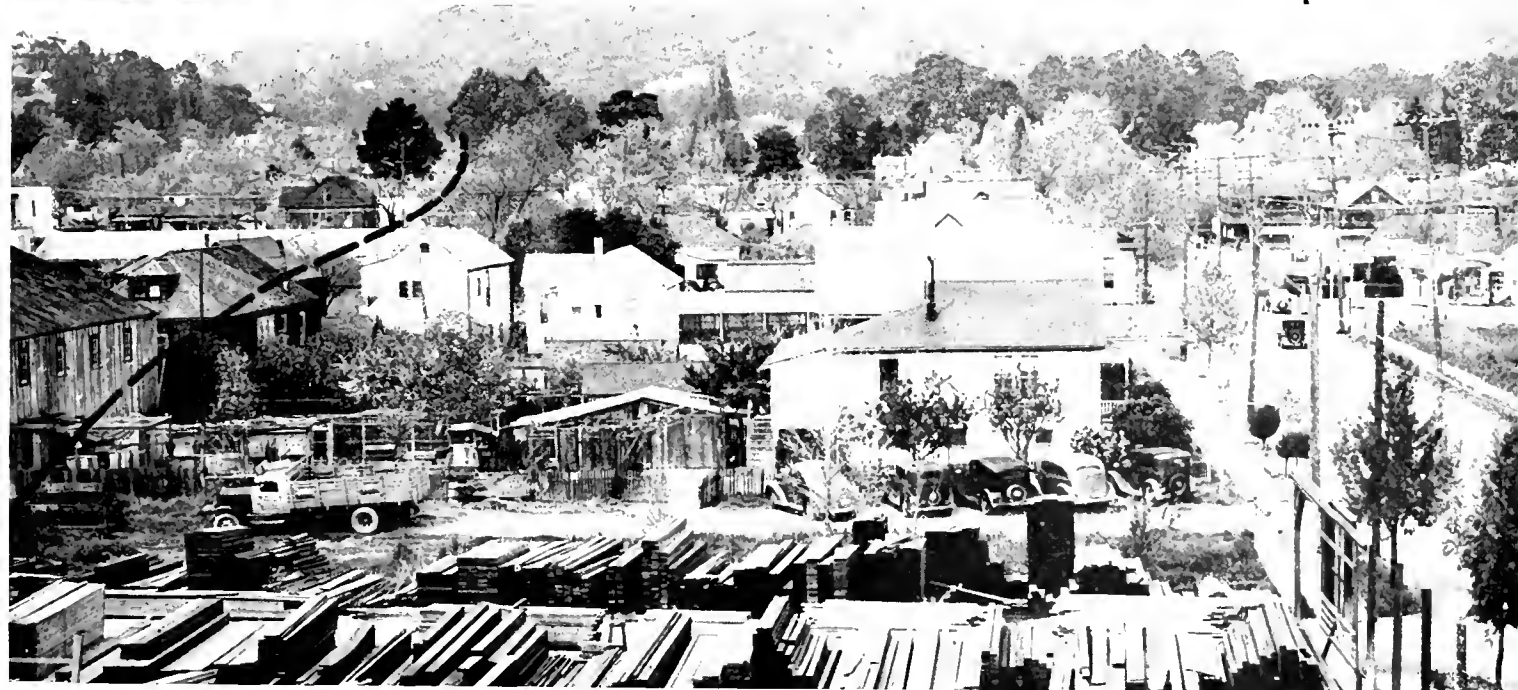
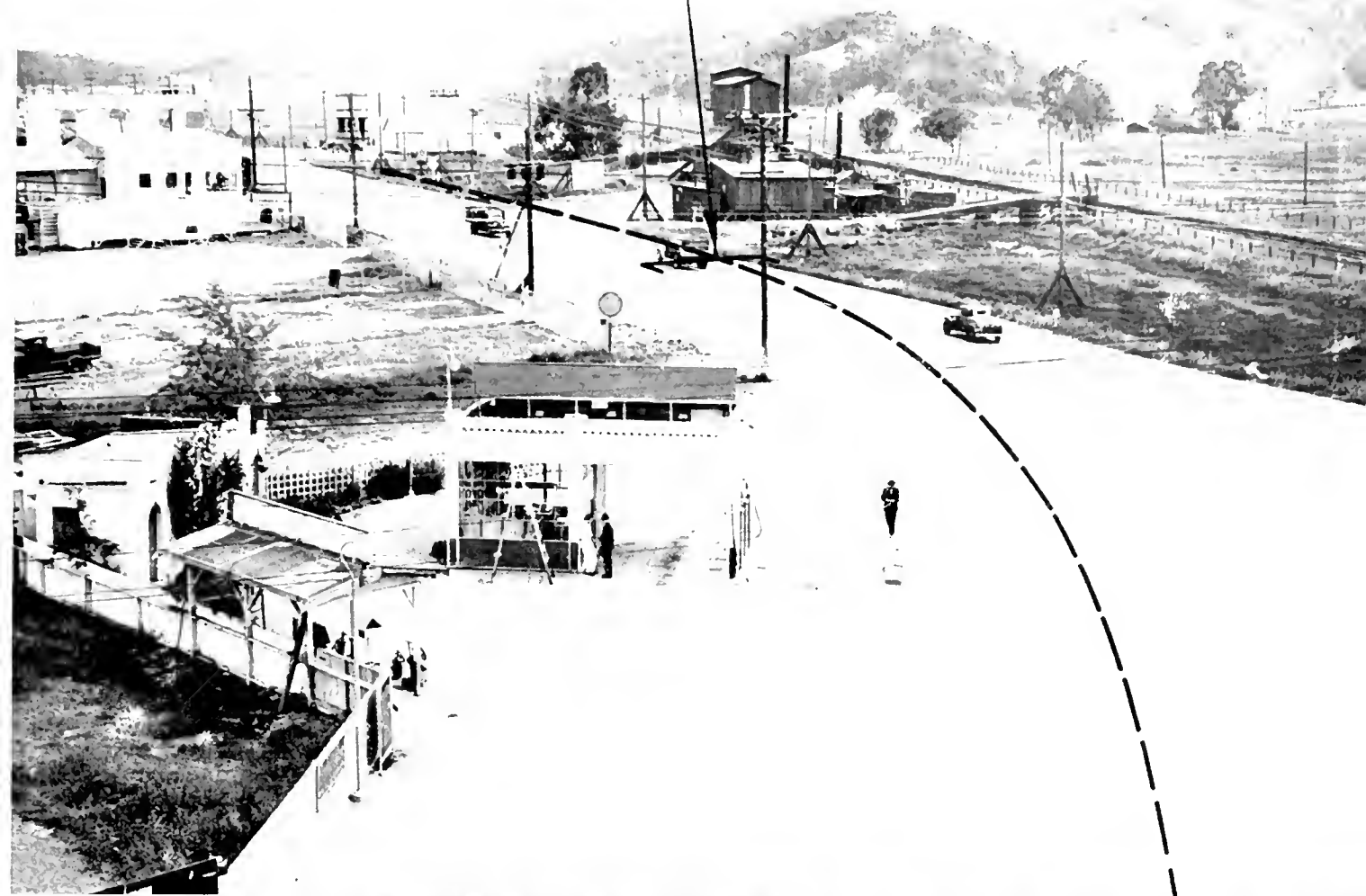
Economic studies indicated that the only permanent solution for breaking the "bottleneck" was to construct an elevated superhighway on a viaduct for a distance of approximately two thousand feet. The viaduct must be high enough to provide grade separations with the important cross city streets—Mission, Fifth, Fourth, Third and Second.

On June 12 bids were received for construction of the San Rafael Viaduct, which, when completed, will open up the congested situation.

The new alignment, instead of utilizing an existing street, is projected half-way between Irwin Street and the Northwestern Pacific Railroad. This results in the least possible disturbance to property values and improvements. A clear right-of-way width of one hundred feet has been provided. This is considered sufficient to cover any future widening which may take place.



SOUTH END OF VIADUCT



Location of proposed superhighway viaduct in relation to existing buildings in San Rafael is shown by black dash lines in above pictures. Buildings are being removed under a right-of-way contract.



Construction of reinforced concrete arch culvert to carry waters of Irwin Creek under four streets beneath viaduct through San Rafael.

Under a right-of-way contract twelve homes, several small buildings, lumber storage sheds and a glove factory have been removed from the right-of-way within the limits of the viaduct.

The viaduct will have a total length of 2207 feet, six inches, and will be fifty-four feet wide, providing two twenty-five-foot roadways separated by a four-foot dividing strip with rolled curb. It will be a reinforced concrete slab and girder design, rigid frame and continuous type, with a total of sixty-seven spans varying in length from seventeen feet to fifty-seven feet six inches, and founded on timber foundation piles. While present construction will provide for four lanes of traffic, the viaduct is designed to allow for future widening.

The superstructure design will be of two types: The northerly nine spans and the southerly twenty-two spans will be of reinforced concrete slab construction, and the interior spans will be of the reinforced concrete girder type. Slab spans will provide minimum clearance for the traffic on cross streets. They will allow a relatively lower grade and obtain improved design economies, especially since the grade line at the ends of the structure is a limiting factor. Transitions from the slab spans to the girder spans are designed continuous. Expansion joints are placed from 120 feet to 150 feet apart.

The structure occupies the creek channel of Irwin Creek, which drainage basin carries the run-off from practically all the streets in the eastern portion of the city. It was therefore necessary to design the bridge with four-column bents or piers to provide a new channel for Irwin Creek along the centerline of the viaduct between the two center columns. Reinforced concrete box culverts will be constructed under Fifth Avenue, Fourth Street, Third Street and Second Street to carry the channel water.

The whole structure is to be founded on piles. Piles are to be driven vertically in the northerly eight hundred feet, while in the remaining portion the outside piles of footings will be driven on a batter. This will be done because of the unstable material of the soil near the surface, which is not conducive to sustaining lateral pressures resulting from temperature changes, earthquakes, wind and live loads.

In a rigid frame structure such as this, where the columns or piers are rigidly fixed to the deck system, the problem of foundations assumes more involved aspects than with the gravity type. In a portion of the structure, where the elevation of footings will be above permanent ground water, treated piles are to be used; whereas the remainder of the piles, which will be below the elevation of permanent ground water and therefore not subjected to alternate wet

and dry conditions, will be untreated.

The southerly 1120 feet of the structure will be on a 1050-foot radius curve. This will be superelevated or banked in accordance with present standards to accommodate safely the fast-moving traffic. At the point of maximum superlevation the west gutter will be four feet higher than the east gutter. The centerline grade has been adjusted by means of a vertical curve. This will eliminate the appearance of a decided dip in the west handrail where the transition from normal crown to the superelevated section takes place.

A unique feature of the structure is that the girders will be curved concentrically with the centerline. This will offer a pleasing and uniform view from underneath. Because the piers have been placed radially to the curve, the use of curved girders will simplify deck form work and also will provide a uniform cantilever distance from the outside girder to the deck.

No free water will be allowed to drip from the roadway to the ground. All rain water which collects on the deck will be carried down the inside columns through downspouts and drainage pipes to the Irwin Creek Channel below the structure.

Electrical conduit will be installed throughout the viaduct to provide for the future placing of luminaires.

The slab spans as well as the girder spans will be constructed on regular

(Continued on page 25)

Modernizing of State Highway System Would Pay Dividends

By FRED GRUMM, Engineer of Surveys and Plans

Following is an address delivered by Mr. Grumm at a recent meeting of the State-wide highway committees of the State Chamber of Commerce in San Francisco.

THE subject of modernization of our State Highway System should be approached with a certain definite understanding. We can assume as an axiom that the State highway transportation system, as now constituted, is a pay-as-you-go public enterprise. It would be wrong to say that it is a nonprofit enterprise because profit can be shown both to the man who foots the bill for the improvement and also to the State as a whole, and in general, possibly even more definitely to the lands and the resources of the State. It is a public business which must be conducted on an economic basis.

This business is not so old—its beginnings are within the adult memories of most of us and it should, therefore, be unnecessary to devote much time to the past history of the growth of the State highway transportation system.

ECONOMIC FACTORS

Its exceptional development and extension has been the direct result of an insistent and continuing public demand for an adequate highway network. This demand has not been particularly concerned with economic considerations—the factor which plays so important a part in the development of privately owned and financed transportation systems or businesses. The people insisted upon the creation of a system of roads to serve public convenience and necessity and got them.

Economic factors were not necessarily disregarded but it is well to emphasize that highway authorities were required to construct and maintain a considerable mileage of highways as a result of public demand. Present or potential traffic on many of these roads will not supply sufficient gas tax revenues to meet capital

outlay charges for a long time in the future, if ever. In other words, present economic considerations have to that extent been made subservient to the general public good.

It is acknowledged to be a good practice to occasionally take an inventory of a business in order to be completely informed on its condition as well as its needs.

A comprehensive inventory of a great public enterprise, the California State highway transportation system, has been completed. This inventory may be better known as the Highway Planning Survey, which has been conducted as a cooperative undertaking by the State Highway Department and the Public Roads Administration.

While the applications to which this information can be put are infinite, the main purpose of the study was to present a complete and authoritative picture of the existing publicly owned transportation system. Before we could intelligently discuss the need for modernization, we had to know what we now possessed, what its condition was, and to what extent it was adequate.

Through this Highway Planning Survey we have investigated and studied the physical conditions, the character of road, the curvature, the grade, the surface, the width, and the bridges. We have studied the volume, type and character of traffic using these roads and their method of operation. We have investigated the type and extent of the loads conveyed by commercial vehicles and the probable future growth of this as well as other traffic. We have studied the progress we are making and its effect upon traffic, and have compared the physical conditions with the requirements imposed. We have discovered, as a result, many surprising things.

These have led us to a study of the financial situation, especially when we find that so many of our highways are not adequate for the demands placed upon them and that as a result the traveling public is subjected to discomfort and hazard and uneconomic operation.

To correct these faults, to increase the comfort of travel, to increase the safety, to make it possible to operate more economically, these highways must be brought to an adequate standard—they must be modernized.

Modernization of the Highways. What do we mean by that expression?

GREATER HIGHWAY WIDTH

1—It means widening our highways, widening the surface and the shoulders.

On the present highway system, we find 6549 miles of road and 725 bridges having a travelable way less than 20 feet in width. The safety of 28 per cent of all rural traffic is exposed to this hazard daily.

In September, 1937, the Division of Highways adopted an increased width of traffic lane. It was increased from the 10 foot width used in the past to 11 feet. In addition, more attention has been given to providing ample shoulders, not only in width but also in type of surface, by providing for a proper treatment of the shoulders.

2—Modernization also means correcting the deficiencies in surface types.

There are 2704 miles of intermediate surface type roads which should be paved and 155 miles of unsurfaced roads requiring either intermediate surface type or pavement.

Demands for so many projects and limitation of funds leads to the practice of substituting a lower and

(Continued on page 24)

Old La Playa Trail Becomes Modern 4-Lane Divided Highway

By BYRON N. SCOTT, Secretary California Highway Commission

CALIFORNIA'S yesterday and her future constituted the theme of ceremonies attendant upon the dedication of the new divided highway on Rosecrans Boulevard in San Diego on June 5. It was my pleasure to represent Governor Culbert L. Olson and Director of Public Works Frank W. Clark on this occasion.

Army, Navy and Marine Corps officers and city, county and State officials, chamber of commerce executives and civic leaders of San Diego participated in the celebration.

In the early days of California Rosecrans Boulevard was known as La Playa Trail, a route over which pioneers traveled from Point Loma, where the ships from far lands anchored, to the soldier camps and missions of the Franciscan Padres on the mainland.

HISTORY REVIEWED

Speakers took for their subject the various periods in the history of California, dating back to the days of Father Junípero Serra and the Spanish administration, the years of Mexican occupation, and the epochal days when the United States took over California.

As each speaker discussed the period of history assigned to him, Spanish and Mexican flags and the Bear Flag of California and the Stars and Stripes were raised by men of the Army, Navy and Marine.

"The Spanish influence started nearly four centuries ago still lives in San Diego," said J. M. Plaza, who talked of the history-making years when the padres and soldiers of old Spain ruled California.

ROLE OF MEXICO

George Montijo, a native son, discussed the role that Mexico played in the development of San Diego and California during the time Mexico ruled the vast domain that was later to become the State of California.

Mr. Scott's Speech

"It is my pleasure and privilege to bring to you the greetings of Governor Culbert L. Olson, Director of Public Works Frank W. Clark and the California Highway Commission, and to present their compliments to the people and officials upon the completion of this highway project.

"It is another example of what we can do through our collective efforts. You people did your part, the city officials, cooperating with the State government, did their part and one of the oldest trails in the State becomes a beautiful thoroughfare.

"I know the Governor and Mr. Clark would have enjoyed an opportunity to participate in dedicating this piece of constructive work because they, as you and I, work to build—not destroy.

"These exercises have been colorful and stand as a shining example of our eagerness to associate ourselves with all peoples who, as we, desire to live in peace and harmony with our fellow men. Let that solidarity of interest and affection stand as a constant reminder to the trouble makers of the world that there is no place in the Americas for them. We love peace but will brood no interference from abroad. We wish to continue the work that we are doing in a constructive way such as this project. We don't want at any time to participate in the work of destruction such as is now going on in Europe. I know that the Governor and Mr. Clark join with me in this sentiment."

"We salute today the courage of those Americans who hoisted the Bear Flag at Sonoma on June 14, 1846, initialing final occupation of this State by the United States Government," said Carl Heilbron, manager of the San Diego Convention Bureau, whose subject had to do with the revolutionary years when General John C. Fremont and the American Army and Navy were making possible the annexation of California to the Union.

Highway Commissioner Bert Vaughn of Jacumba, Mayor P. J. Benbough of San Diego and Rear Admiral Joseph R. Defrees, commandant of the eleventh naval district, joined in cutting a ribbon officially opening the new highway.

IN SECONDARY SYSTEM

Rosecrans Boulevard is in the Secondary State Highway System, and the portion improved was from Lytton Street to Canon Street, a length of 1.92 miles. The new broad thoroughfare serves the Point Loma section as a connection to the business district, is the main highway to Fort Rosecrans, and is also the route to the Cabrillo National Monument, which is the westerly terminus of Route 12.

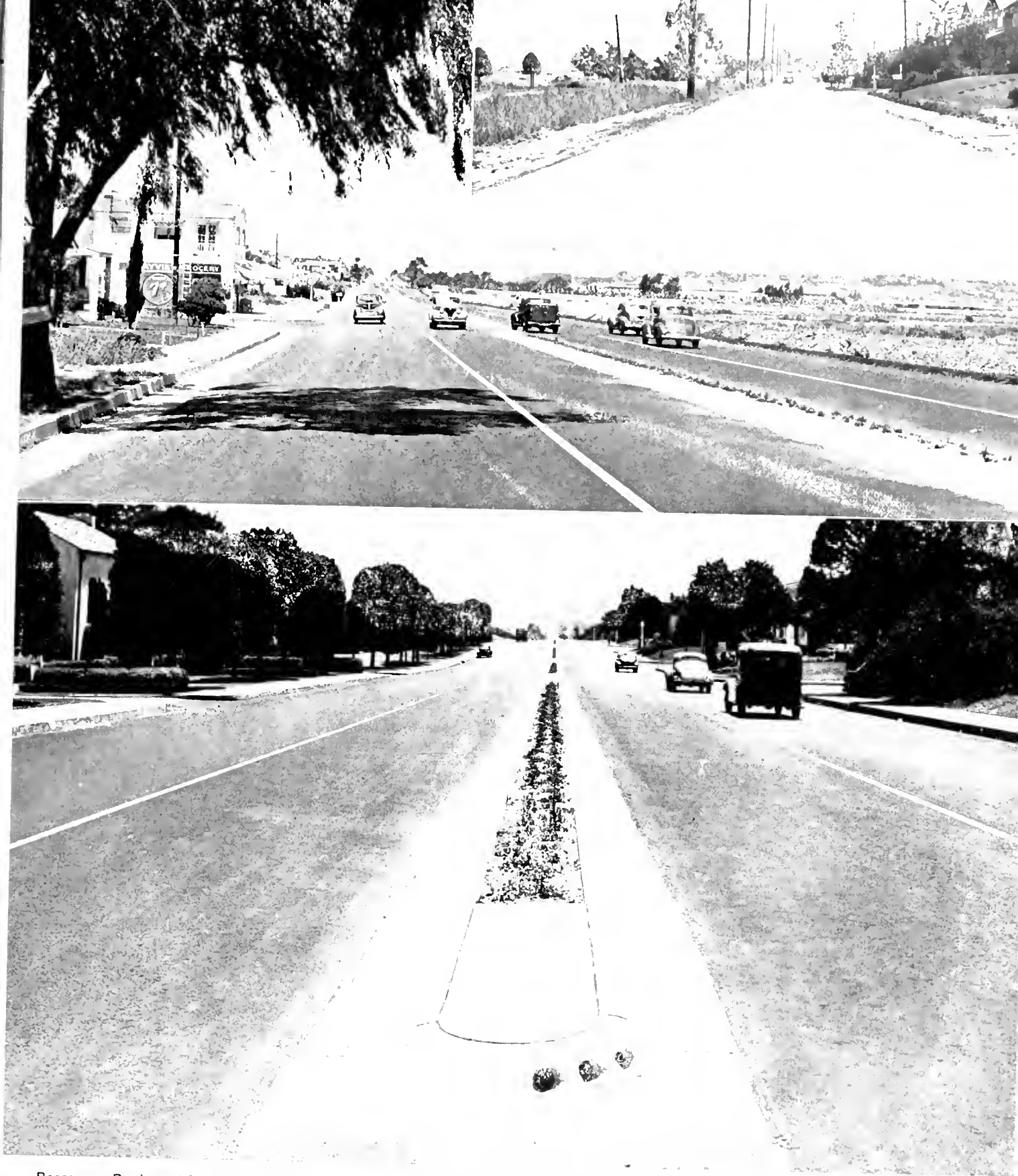
Just a few months ago this street consisted of a narrow, two-lane pavement, 20 feet in width, congested with traffic, with unsightly power poles down the side, and subject to flooding during storm periods. Now traffic is served by a beautiful divided highway, consisting of two 23-foot lanes of asphaltic concrete pavement, and 8-foot parking strips. The two lanes are separated by a planted dividing strip.

EXTENSIVE STORM DRAIN SYSTEM

New curbs and gutters were constructed at various locations, and the storm waters were provided for by an extensive system of storm drains.

Construction on the project was started in December of 1939 and all

(Continued on page 17)



Rosecrans Boulevard in San Diego was originally the old La Playa Trail leading from Point Loma inland in the days of the Padres and the missions. In later years it was a narrow two-lane highway. Today it is a broad, 4-lane divided highway with two 23-foot traffic lanes separated by a planted and curbed dividing strip. The inset shows the old highway before improvement.



Pescadero Beach on San Mateo County Coast across which a right of way has been secured for State Highway 56.

Beaches, Lake and Island Acquired in Highway Right of Way Deal

By J. B. WOODSON, Right of Way Agent

IN THE course of studies for the location of a portion of the Coast Highway in San Mateo County between Tunitas and Lake Lucerne, consideration was given to the fact that this section of highway when completed would make readily accessible to the motorist many natural beauty spots along this stretch of coast.

The location follows the ocean quite closely but there were a number of spots where a narrow strip remained between the right of way required for the highway and the beach.

It seemed almost imperative that these unspoiled beaches and coves be preserved in their natural state

for the enjoyment of the public. San Mateo County officials have a long, enviable record of acquiring recreational and scenic areas for the benefit of their citizens and visitors. They therefore gladly cooperated through the board of supervisors and the planning engineer, in securing many of these areas for the public.

RECREATIONAL VALUES PRESERVED

It was realized that in order to secure these areas at a reasonable figure purchase would have to be made in advance of the highway construction. Once this highway was open, many of these spots would be in demand as sites for hot dog

stands, auto camps, sign boards, etc., and their value as real estate would be considerably enhanced while the recreational value of the region as a whole would be seriously impaired.

With these facts in mind the Division of Highways, acting in conjunction with the officials of San Mateo County, decided to purchase as much as possible of these coast lands. The State's Right of Way Department was delegated to make the negotiations. In so doing the plan was disclosed to the property owners so that they were perfectly cognizant of the proposal. By purchasing the lands necessary for the highway right of way in conjunction

(Continued on page 25)



Three of the beautiful small ocean beaches on the San Mateo coast acquired for public use through a State Highway right of way deal. At top—a portion of Pebble Beach containing varicolored pebbles, coveted for home decoration. Central picture—shows the charming, crescent beach line of Arroyo de las Frijoles (Bean Hollow). The bottom picture shows an island lot just below Pescadero Beach which through the right of way deal becomes public property together with a strip of level shoreline.

GASOLINE TAX APPORTIONMENTS TO CITIES AND

(Continued)

City	$\frac{1}{2}$ ¢ for State Highways and City Streets in Cities	1¢ for County Roads	Total	City	$\frac{1}{2}$ ¢ for State Highways and City Streets in Cities	1¢ for County Roads	Total
ALAMEDA CO.		\$1,058,666.98		FRESNO CO.—Continued			
Alameda	\$67,637.16			Reedley	\$4,998.50		
Albany	16,543.92			Sanjer	5,728.30		
Berkeley	158,525.40			San Joaquin	314.68		
Emeryville	4,510.04			Selma	5,882.76		
Hayward	10,676.62			Totals, Fresno Co.	\$136,896.46	\$453,583.68	\$590,480.14
Livermore	6,021.74			GLENN CO.		\$63,717.23	
Oakland	548,431.92			Orland	\$2,307.16		
Piedmont	18,018.94			Willows	3,907.68		
Pleasanton	2,388.22			Totals, Glenn Co.	\$6,214.84	\$63,717.23	69,932.07
San Leandro	22,151.54			HUMBOLDT CO.		\$130,903.21	
Totals, Alameda Co.	\$854,905.50	\$1,058,666.98	\$1,913,572.48	Arcata	\$3,299.50		
ALPINE CO.		\$30,814.58		Blue Lake	1,071.52		
No Cities	\$0.00			Eureka	30,411.92		
Totals, Alpine Co.	\$0.00	\$30,814.58	30,814.58	Ferndale	1,716.38		
AMADOR CO.		\$49,814.59		Fortuna	2,392.08		
Amador	\$330.16			Trinidad	206.58		
Jackson	3,871.00			Totals, Humboldt Co.	\$39,097.98	\$130,903.21	170,001.19
Plymouth	662.20			IMPERIAL CO.		\$170,281.23	
Sutter Creek	1,955.76			Brawley	\$20,154.28		
Totals, Amador Co.	\$6,819.12	\$49,814.59	56,633.71	Calexico	12,161.30		
BUTTE CO.		\$138,919.29		Calipatria	3,000.26		
Biggs	\$893.90			El Centro	16,283.28		
Chico	15,370.08			Holtville	3,394.12		
Gridley	3,747.42			Imperial	3,751.28		
Oroville	8,693.80			Westmorland	2,849.66		
Totals, Butte Co.	\$28,705.20	\$138,919.29	167,624.49	Totals, Imperial Co.	\$61,594.18	\$170,281.23	231,875.41
CALAVERAS CO.		\$50,680.97		INYO CO.		\$49,118.93	
Angels	\$1,766.56			Bishop	\$2,237.64		
Totals, Calaveras Co.	\$1,766.56	\$50,680.97	52,447.53	Totals, Inyo Co.	\$2,237.64	\$49,118.93	51,356.57
COLUSA CO.		\$58,542.26		KERN CO.		\$350,714.36	
Colusa	\$4,085.32			Bakersfield	\$50,226.38		
Williams	1,677.72			Delano	5,081.52		
Totals, Colusa Co.	\$5,763.04	\$58,542.26	64,305.30	Maricopa	2,067.76		
CONTRA COSTA CO.		\$241,188.16		Shafter	2,505.90		
Antioch	\$10,006.66			Taft	6,645.36		
Concord	2,172.00			Tehachapi	1,420.98		
El Cerrito	7,471.70			Totals, Kern Co.	\$67,947.90	\$350,714.36	418,662.26
Hercules	756.82			KINGS CO.		\$114,451.07	
Martinez	15,312.12			Corcoran	\$3,413.44		
Pinole	1,507.84			Hanford	13,568.74		
Pittsburg	18,553.74			Lemoore	2,701.02		
Richmond	39,826.84			Totals, Kings Co.	\$19,683.20	\$114,451.07	134,134.27
Walnut Creek	1,957.72			LAKE CO.		\$52,741.44	
Totals, Contra Costa Co.	\$97,565.44	\$241,188.16	338,753.60	Lakeport	\$2,544.66		
DEL NORTE CO.		\$41,111.35		Totals, Lake Co.	\$2,544.66	\$52,741.44	55,286.10
Crescent City	\$3,320.74			LASSEN CO.		\$60,249.66	
Totals, Del Norte Co.	\$3,320.74	\$41,111.35	44,432.09	Susanville	\$2,621.88		
EL DORADO CO.		\$58,902.06		Totals, Lassen Co.	\$2,621.88	\$60,249.66	62,871.54
Placerville	\$4,569.90			LOS ANGELES CO.		\$6,114,103.59	
Totals, El Dorado Co.	\$4,569.90	\$58,902.06	63,471.96	Alhambra	\$56,900.70		
FRESNO CO.		\$453,583.68		Arcadia	10,070.38		
Clovis	\$2,540.76			Avalon	3,662.48		
Coalinga	5,504.34			Azusa	9,282.66		
Firebaugh	976.92			Bell	15,221.40		
Fowler	2,260.82			Beverly Hills	33,649.66		
Fresno	105,048.12			Burbank	32,168.80		
Kingsburg	2,552.34			Claremont	5,249.48		
Parlier	1,088.92			Compton	24,164.26		
				Covina	5,378.86		
				Culver City	10,944.98		
				El Monte	6,716.82		

COUNTIES FOR FISCAL YEAR ENDED JUNE 30, 1940

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City	1¢ for State Highways and City Streets in Cities	1¢ for County Roads	Total
LOS ANGELES CO.—Continued			
El Segundo	\$6,763.16		
Gardena	13,599.66		
Glendale	121,122.52		
Glendora	5,330.58		
Hawthorne	12,734.68		
Hermosa Beach	9,259.48		
Huntington Park	47,477.12		
Inglewood	41,356.88		
La Verne	5,521.72		
Long Beach	275,873.42		
Los Angeles	2,395,140.92		
Lynwood	14,138.30		
Manhattan Beach	3,650.88		
Maywood	16,267.82		
Monrovia	21,025.00		
Montebello	10,614.80		
Monterey Park	12,367.86		
Palos Verdes Estates	1,368.32		
Pasadena	147,429.84		
Pomona	40,165.64		
Redondo Beach	18,045.98		
San Fernando	14,609.36		
San Gabriel	14,091.96		
San Marino	7,201.40		
Santa Monica	71,716.66		
Sierra Madre	6,853.88		
Signal Hill	5,660.72		
South Gate	37,902.90		
South Pasadena	26,508.10		
Torrance	17,055.54		
Vernon	2,450.04		
West Covina	1,924.88		
Whittier	28,662.72		
Totals, Los Angeles Co.	\$3,667,303.22	\$6,114,103.59	\$9,781,406.81
MADERA CO.			
Chowchilla	\$1,635.26	\$84,939.39	
Madera	9,006.58		
Totals, Madera Co.	\$10,641.84	\$84,939.39	95,581.23
MARIN CO.			
Belvedere	\$965.34	\$123,804.94	
Corte Madera	1,982.80		
Fairfax	5,647.22		
Larkspur	2,395.96		
Mill Valley	8,039.30		
Ross	2,616.06		
San Anselmo	8,977.62		
San Rafael	15,487.82		
Sausalito	7,079.76		
Totals, Marin Co.	\$53,191.88	\$123,804.94	176,996.82
MARIPOSA CO.			
Hornitos	\$119.70	\$43,488.95	
Totals, Mariposa Co.	\$119.70	\$43,488.95	43,608.65
MENDOCINO CO.			
Fort Bragg	\$5,834.48	\$84,738.93	
Point Arena	743.30		
Ukiah	6,031.42		
Willits	2,749.28		
Totals, Mendocino Co.	\$15,358.48	\$84,738.93	100,097.41
MERCED CO.			
Atwater	\$1,770.42	\$137,038.83	
Dos Palos	1,795.54		
Gustine	1,961.54		
Livingston	1,550.32		

City	1¢ for State Highways and City Streets in Cities	1¢ for County Roads	Total
MERCED CO.—Continued			
Los Banos	\$3,620.02		
Merced	13,642.12		
Totals, Merced Co.	\$24,339.96	\$137,038.83	\$161,378.79
MODOC CO.			
Alturas	\$4,513.92	\$49,320.92	
Totals, Modoc Co.	\$4,513.92	\$49,320.92	53,834.84
MONO CO.			
No Cities	\$0.00	\$34,899.51	
Totals, Mono Co.	\$0.00	\$34,899.51	34,899.51
MONTEREY CO.			
Carmel-by-the-Sea	\$4,363.34	\$195,742.42	
King	2,863.20		
Monterey	17,648.24		
Pacific Grove	10,730.64		
Salinas	20,202.52		
Soledad	1,146.82		
Totals, Monterey Co.	\$56,954.76	\$195,742.42	252,697.18
NAPA CO.			
Calistoga	\$1,930.66	\$91,108.01	
Napa	12,427.72		
St. Helena	3,054.34		
Totals, Napa Co.	\$17,412.72	\$91,108.01	108,520.73
NEVADA CO.			
Grass Valley	\$7,369.34	\$70,732.14	
Nevada City	3,284.08		
Totals, Nevada Co.	\$10,653.42	\$70,732.14	81,385.56
ORANGE CO.			
Anaheim	\$21,262.46	\$362,055.99	
Brea	4,701.20		
Fullerton	20,967.06		
Huntington Beach	7,124.18		
Laguna Beach	3,826.66		
La Habra	4,388.40		
Newport Beach	4,253.26		
Orange	15,572.78		
Placentia	3,100.66		
San Clemente	1,287.76		
Santa Ana	58,541.78		
Seal Beach	2,231.86		
Tustin	1,787.82		
Totals, Orange Co.	\$149,043.88	\$362,055.99	511,099.87
PLACER CO.			
Auburn	\$5,137.52	\$97,297.99	
Colfax	1,760.76		
Lincoln	4,042.80		
Rocklin	1,397.82		
Roseville	12,404.56		
Totals, Placer Co.	\$24,743.46	\$97,297.99	122,041.45
PLUMAS CO.			
No Cities	\$0.00	\$52,022.44	
Totals, Plumas Co.	\$0.00	\$52,022.44	52,022.44
RIVERSIDE CO.			
Banning	\$5,342.16	\$267,877.80	
Beaumont	2,571.64		
Blythe	1,969.30		
Corona	13,549.44		
Elsinore	2,606.40		
Hemet	4,315.04		
Indio	5,021.66		
Palm Springs	4,929.02		
Perris	1,473.12		

City	10 for State Highways and City Streets in Cities	10 for County Roads	Total
RIVERSIDE CO.—Continued			
Riverside	\$57,333.16		
San Jacinto	2,598.68		
Totals, Riverside Co.	\$101,709.62	\$267,877.80	\$369,587.42
SACRAMENTO CO.			
Isleton	\$5,610.54	\$415,162.90	
North Sacramento	5,120.14		
Sacramento	181,000.30		
Totals, Sacramento Co.	\$191,730.98	\$415,162.90	606,893.88
SAN BENITO CO.			
Hollister	\$7,253.52	\$60,006.36	
San Juan	1,490.50		
Totals, San Benito Co.	\$8,744.02	\$60,006.36	68,750.38
SAN BERNARDINO CO.			
Chino	\$6,019.84	\$382,138.77	
Colton	15,489.76		
Needles	6,070.00		
Ontario	26,224.30		
Redlands	27,371.12		
Rialto	3,170.18		
San Bernardino	75,427.40		
Upland	9,099.24		
Totals, San Bernardino Co.	\$168,871.84	\$382,138.77	551,010.61
SAN DIEGO CO.			
Chula Vista	\$7,469.76	\$622,967.53	
Coronado	10,473.88		
El Cajon	2,027.22		
Escondido	6,604.82		
La Mesa	4,851.78		
National City	14,095.82		
Oceanside	6,784.36		
San Diego	292,871.04		
Totals, San Diego Co.	\$345,178.68	\$622,967.53	968,146.21
SAN FRANCISCO CO.			
San Francisco	\$1,224,805.44	\$1,045,712.07	
Totals, San Francisco Co.	\$1,224,805.44	\$1,045,712.07	2,270,517.51
SAN JOAQUIN CO.			
Lodi	\$14,340.78	\$325,746.72	
Manteca	3,116.12		
Stockton	92,600.70		
Tracy	7,392.54		
Totals, San Joaquin Co.	\$117,450.14	\$325,746.72	443,196.86
SAN LUIS OBISPO CO.			
Arroyo Grande	\$1,722.14	\$114,092.70	
Paso Robles	4,967.62		
Pismo Beach	2,313.44		
San Luis Obispo	15,978.22		
Totals, San Luis Obispo Co.	\$24,981.42	\$114,092.70	139,074.12
SAN MATEO CO.			
Atherton	\$2,556.20	\$257,616.44	
Bayshore	1,690.94		
Belmont	1,928.74		
Burlingame	25,619.98		
Daly City	16,285.20		
Hillsborough	3,679.88		
Lawndale	712.44		
Menlo Park	4,351.72		
Redwood City	17,302.68		
San Bruno	6,969.74		
San Carlos	2,185.52		
San Mateo	25,979.08		
South San Francisco	11,956.62		
Totals, San Mateo Co.	\$121,218.74	\$257,616.44	378,835.18

City	10 for State Highways and City Streets in Cities	10 for County Roads	Total
SANTA BARBARA CO.			
Lompoc	\$5,492.76	\$204,802.28	
Santa Barbara	64,895.60		
Santa Maria	13,624.74		
Totals, Santa Barbara Co.	\$84,013.10	\$204,802.28	\$288,815.38
SANTA CLARA CO.			
Alviso	\$735.58	\$448,354.81	
Gilroy	6,761.22		
Los Gatos	6,116.36		
Morgan Hill	1,753.06		
Mountain View	6,386.66		
Palo Alto	26,803.48		
San Jose	120,909.64		
Santa Clara	12,167.08		
Sunnyvale	5,973.48		
Totals, Santa Clara Co.	\$187,606.56	\$448,354.81	635,961.37
SANTA CRUZ CO.			
Santa Cruz	\$27,791.98	\$143,051.92	
Watsonville	16,682.94		
Totals, Santa Cruz Co.	\$44,474.92	\$143,051.92	187,526.84
SHASTA CO.			
Redding	\$8,085.66	\$96,367.51	
Totals, Shasta Co.	\$8,085.66	\$96,367.51	104,453.17
SIERRA CO.			
Loyalton	\$1,615.98	\$36,579.55	
Totals, Sierra Co.	\$1,615.98	\$36,579.55	38,195.53
SISKIYOU CO.			
Dorris	\$1,471.16	\$91,875.30	
Dunsmuir	5,039.06		
Etna	731.76		
Fort Jones	583.06		
Montague	978.84		
Mount Shasta	2,052.28		
Tulelake	579.20		
Yreka	4,249.40		
Totals, Siskiyou Co.	\$15,684.76	\$91,875.30	107,560.06
SOLANO CO.			
Benicia	\$5,624.02	\$132,779.32	
Dixon	1,930.66		
Fairfield	2,183.58		
Rio Vista	2,527.22		
Suisun City	1,747.28		
Vacaville	3,606.50		
Vallejo	29,494.86		
Totals, Solano Co.	\$47,114.12	\$132,779.32	179,893.44
SONOMA CO.			
Cloverdale	\$1,465.38	\$207,359.61	
Healdsburg	4,432.80		
Petaluma	15,918.40		
Santa Rosa	20,774.82		
Sebastopol	3,401.86		
Sonoma	1,892.06		
Totals, Sonoma Co.	\$47,885.32	\$207,359.61	255,244.93
STANISLAUS CO.			
Ceres	\$1,893.98	\$219,380.00	
Modesto	27,213.78		
Newman	2,450.04		
Oakdale	4,077.54		
Patterson	1,747.28		
Riverbank	1,550.34		
Turlock	8,255.54		
Totals, Stanislaus Co.	\$47,188.50	\$219,380.00	266,568.50
SUTTER CO.			
Yuba City	\$6,960.08	\$75,744.64	
Totals, Sutter Co.	\$6,960.08	\$75,744.64	82,704.72

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Cahuenga Freeway Unit Opened

(Continued from page 4)

late in 1938 to take advantage of PWA funds which were then available. The first two contracts were for grading the east roadway between Hollyerest Drive and 3,600 feet southerly at costs of \$41,000 and \$97,000, respectively. These were followed by construction of a reinforced concrete bridge over the freeway at Mulholland Drive at a cost of \$88,000.

The fourth and largest contract to date was reconstruction of the intersection of Cahuenga and Highland boulevards and construction of the "freeway" from this intersection to a point about one mile northerly. This contract was completed June 15, 1940, and actually puts into service somewhat less than one mile of completed freeway.

The benefit of this completed portion of the freeway was immediately reflected in the ease with which a tremendous volume of traffic is handled through the completed portion and particularly at the Highland Avenue intersection. This contract was a splendid example of a smooth running construction organization which completed a large, complicated project under full traffic in the amazingly short time of 4½ months. The cost of this contract was \$831,000 and it was rushed through to meet the time limit fixed by the PWA. The contractors

were J. E. Haddock, Ltd., of Pasadena.

On May 13, 1940, another contract was started to continue the freeway northerly for about 0.7 mile. This is estimated to cost \$650,000, and the time limit for completion is December 15, 1940. On its completion, slightly more than one-half of the Cahuenga Pass Freeway will be opened to public traffic. Plans are nearing completion for another section about one mile in length to carry the improvement to Lankershim Boulevard.

Plans for the project and construction engineering have been under the direction of City Engineer Aldrich. Financing has for the most part been from PWA and State highway funds although the city and county have each made substantial contributions.

Funds for contracts completed or now under way have been contributed approximately as follows:

Federal Public Works Administration Funds	\$763,000
State Highway Funds, 1½¢ Gas Tax Funds	690,000
½¢ State Highway Gas Tax, City of Los Angeles	196,000
County of Los Angeles Funds ..	25,000
City of Los Angeles Funds	32,000
Total funds spent or obligated to date	\$1,707,000

(Continued on page 20)

La Playa Trail a 4-Lane Highway

(Continued from page 10)

work was completed on May 18, 1940. Griffith Company, the contractor on this project, by means of efficient crews and equipment, completed the project approximately three months before the contract date of completion.

Major items of construction consisted of the storm drain system, the total cost of which approximated one-third of the total cost of the work. This extensive system was necessary to provide for the heavy runoff from the sloping hills to the west of the project.

Another interesting feature of the construction was the treatment of the subgrade material.

This treatment of the subgrade also provided a suitable traveled way for the public traffic, as it was necessary that one-half of the street be used while the other half was being constructed.

The total cost of the project of contract items and supplemental work amounted to approximately \$180,000.

The improvement was supervised for the state by R. C. Payne, Resident Engineer, under the direction of E. E. Wallace, District Engineer, and Earl E. Sorenson, District Construction Engineer.

Gasoline Tax Apportionments to Cities and Counties

(Continued from page 16)

City	½¢ for State Highways and City Streets in Cities	1¢ for County Roads	Total
TEHAMA CO.		\$67,319.44	
Corning	\$2,658.52		
Red Bluff	6,790.16		
Tehama	366.82		
Totals, Tehama Co. ..	\$9,815.50	\$67,319.44	\$77,134.94
TRINITY CO.		\$38,367.39	
No Cities	\$0.00		
Totals, Trinity Co. ..	\$0.00	\$38,367.39	38,367.39
TULARE CO.		\$272,713.40	
Dinuba	\$5,730.22		
Exeter	5,402.68		
Lindsay	7,487.14		
Porterville	10,238.34		
Tulare	12,001.06		
Visalia	14,022.46		
Woodlake	1,040.72		
Totals, Tulare Co. ..	\$55,922.62	\$272,713.40	328,636.02
TUOLUMNE CO.		\$55,710.70	
Sonora	\$4,398.08		
Totals, Tuolumne Co.	\$4,398.08	\$55,710.70	60,108.78

City	½¢ for State Highways and City Streets in Cities	1¢ for County Roads	Total
VENTURA CO.		\$183,021.04	
Fillmore	\$5,585.44		
Ojai	2,834.20		
Oxnard	12,134.26		
Santa Paula	14,387.36		
Ventura	22,401.56		
Totals, Ventura Co. ..	\$57,342.82	\$183,021.04	\$240,363.86
YOLO CO.		\$99,189.27	
Davis	\$2,399.82		
Winters	1,729.88		
Woodland	10,769.28		
Totals, Yolo Co.	\$14,898.98	\$99,189.27	114,088.25
YUBA CO.		\$72,928.65	
Marysville	\$11,126.44		
Wheatland	924.80		
Totals, Yuba Co.	\$12,051.24	\$72,928.65	84,979.89
GRAND TOTALS	\$8,326,280.60	\$16,652,561.22	\$24,978,841.82



Governor Olson speaking to the assemblage at the dedication of the Culbert L. Olson Grove on the Redwood Highway.

Culbert L. Olson Grove Dedicated

LOCATED on State Highway 101 the Redwood Highway, about a mile north of Garberville, a noble stand of giant Redwood trees was dedicated in honor of Governor Olson by Chairman Matthew Gleason of the State Park Commission on June 28th and named the Culbert L. Olson Grove.

The grove is a part of the Avenue of the Giants tract of 400 acres acquired by the State on June 7 at a cost of \$217,000. Funds were supplied by State appropriation from oil royalties and private donations.

In his acknowledgment of the dedication of the grove in his honor Governor Olson said in part to the group of approximately 500 persons present:

"This is one of the most impressive events—one of the most outstanding occasions in my whole life. And the thoughts that occur to me when this honor is brought to me of dedicating

this wonderful grove in my name are these:

"First, my concern and my hope that it meets with the approval of you who live in this great Redwood Empire and are so directly connected with its preservation and maintenance—not only the naming of these parks but the maintenance of them for the future generations of this State of ours and of the United States.

"Second, that it will also be not disapproved by our other fellow citizens throughout the State; and

"Third, and most important of all, that I may so live and conduct myself the rest of my life that no one will look at the name of this grove and have cause to disapprove its being named in my honor.

"It is indeed a great honor. It means more than a temporary honor because it preserves the name of me and my family for the future years in

a very enduring way; in a more enduring way perhaps than would otherwise find it preserved.

"It is, I feel, not inappropriate that our wonderful groves in these State parks be named in honor of those who have been chosen by their fellow citizens to act as their governor during their lives; and I realize that it is my position today which enables me to have this additional honor conferred upon me.

"It will be my purpose as long as I am in office to recommend that the dedication of other groves, when the time comes for naming them, shall be in honor of past governors of our State, in whose honor groves have not yet been named.

"To express thanks to those who have inspired and brought about the dedication of this most wonderful scenic spot in my name, I could not do adequately in words. But my feel-

(Continued on page 19)

Secretary Byron N. Scott Resigns Position With Highway Commission

AFTER fifteen months as Secretary of the California Highway Commission, Byron N. Scott resigned his position on June 28, 1940. Scott delivered his resignation to Director of Public Works Frank W. Clark and Larry Barrett, Chairman of the Commission, who accepted it on behalf of Governor Culbert L. Olson.

In his letter of resignation Scott said:

"You are undoubtedly aware of the fact that I have announced my candidacy for Congress from the 18th California District.

"I find that the demands on my time will be so great that it would be impossible for me to do justice to my work as Secretary of the Commission and my campaign at the same time.

"I am therefore, by this letter, tendering to you my resignation as Secretary of the Commission, to be effective on the last day of this month.

"It has been a pleasure to work with you and the Commission. Never have I seen a more active, hard-working and dependable group of men sincerely interested in the welfare of the State and its highway needs. If at any time I can be of service to you and the Commission, I am at your service."

RESOLUTION BY HIGHWAY COMMISSION

WHEREAS, Byron N. Scott, Secretary of the California Highway Commission, has this day submitted his resignation as Secretary of said Commission in order to promote his candidacy for Congress from the 18th California District; and

WHEREAS, The California Highway Commission feels a deep debt of gratitude to Byron N. Scott for the many favors that have been extended by the Secretary to the Commission and for the good work that has been done by Byron N. Scott as Secretary of the Commission in the discharge of his duties; and

WHEREAS, Byron N. Scott, as Secretary of the California Highway Commission, has created an ever increasing respect for the State administration in his daily contacts with the people throughout the State; and

WHEREAS, The members of the Cali-

fornia Highway Commission believe that the resignation of Byron N. Scott will create a vacancy that will be difficult to fill, though they are nevertheless aware of the fact that he may better serve his country as a representative to Congress; and

WHEREAS, It is the consensus of the members of the California Highway Commission that the feeling of gratitude and thanks that the Commission holds for Byron N. Scott should be spread upon the minutes of this meeting and that Honorable Culbert L. Olson, Governor of our State, should be informed of the gratitude of the California Highway Commission for the splendid cooperation of Byron N. Scott in the discharge of his duties as Secretary to the Commission, now, therefore, be it

Resolved, That the California Highway Commission, in regular meeting duly assembled this 26th day of June, 1940, at Los Angeles, California, does hereby extend its sincere thanks and express its gratitude to Byron N. Scott, Secretary of the California Highway Commission, for the good work he had accomplished during his tenure of office, and for the sympathetic understanding so frequently displayed by him in the solution of the problems confronting the Commission; and be it further

Resolved, That this expression of gratitude of the California Highway Commission be spread upon the minutes of this session, and that a copy thereof be forwarded to our good Governor, Culbert L. Olson, at Sacramento, California, and that a copy thereof be forwarded to Byron N. Scott and to Mrs. Byron N. Scott, the charming wife of our Secretary.

Culbert L. Olson Grove Dedicated

(Continued from page 18)

ings concerning it I assure you are felt to the depth of my heart."

Following the dedication of the grove, Father Caffery, member of the Park Commission, dedicated Kate Olson big tree in memory of Governor Olson's late departed wife. This tree is 355 feet tall and is but 9 feet shorter than the tallest redwood tree.

Engineers Organize Class for Bridge Design

A REPORT made to State Highway Engineer C. H. Purcell by Glenn L. Eneke, Associate Bridge Engineer, illustrates the interest that the personnel of the Bridge Department and other employees of the State Division of Highways take in their jobs and an opportunity to improve their knowledge. Upon petition by fifty engineers of the Bridge Department, a course on "bridge design" was installed as part of the Sacramento Evening School program during the winter and spring terms of the current year.

Class work was organized on an eighteen week basis with an ultimate enrollment of 150 men divided into two sections, each section meeting in a two-hour session one night weekly.

Membership in the course was drawn from twenty different public and private organizations, with approximately 55 men enrolled from the Bridge Department, the remainder being distributed among other branches of the Division of Highways, Division of Architecture, Division of Water Resources, U. S. War Department engineers, U. S. Reclamation engineers, other Federal agencies and city and county engineers.

The course was concerned primarily with structural design methods, using present bridge practices as a means of illustration. Briefly, an effort was made to develop in the class (1) an appreciation of what is important and what is not in structural design; (2) methods of analysis that are comparable in accuracy to the material being worked with; (3) ability to visualize the shape of a deformed structure subjected to load and to recognize the nature of the stresses set up as a result of this deformation.

The class undertook a design problem in reinforced concrete for a typical 750-foot three-lane bridge with sidewalks. Thirteen different span length combinations between 30 and 100 feet, each with three or five lines of girders, were designed. The resulting 26 design problems were distributed to squads of five or six men. Their combined efforts were assembled

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Russian Gulch Bridge on Mendocino Coast Highway Officially Dedicated

THE BRIDGE across Russian Gulch, located about nine miles south of Fort Bragg on the "Shoreline Highway" in Mendocino County, was officially dedicated June 9th when Governor Olson and party visited that section. The bridge is expected to be completed about July 10th.

This structure is 526 feet-9 inches long and consists of a reinforced concrete open spandrel arch with 240 foot span with reinforced concrete girder approach spans. The roadway width is 26 feet. In addition to the bridge construction, 2800 feet of approaches were constructed and paved to a minimum roadway width of 24 feet.

The new bridge replaces an old timber trestle which was located about 500 feet further upstream. The old structure was built by Mendocino County about thirty years ago. The old structure was designed to support a 6-horse team, but since that time increased loads have made it unsafe for present day requirements.

LOCATED ON NEW ALIGNMENT

The Shoreline Highway was incorporated into the State Highway System in 1933. The road more or less follows the natural ground contours which was the accepted practice at the time the road was built. However, since that time modern traffic requires considerable improvement in alignment and grade.

On a large section of this road studies have been made for a projected alignment which will ultimately provide a highway that will safely and adequately handle its traffic requirements. The new Russian Gulch Bridge is located on this projected alignment. Temporary approaches have been constructed to provide connections from the bridge to the existing road.

PROGRESSIVE IMPROVEMENT PROJECT

In 1936 the State expended \$1600 to make repairs and improvements to the old bridge sufficient to place the structure in a satisfactory condition until such time that it could be re-



PAUL PEEK

placed. Since many of the bridges on this route can not handle legal loads, the primary consideration has been to replace these weak bridges as soon as money becomes available. In replacing these old bridges with structures of a permanent type, careful consideration has been given so that the new structures will be located on ultimate alignment. In the future, the roadway between the bridges will be improved and the whole will provide a continuous highway of uniform design standard.

The bridge and approaches were constructed at a cost of \$109,000 by Contractor R. G. Clifford; George A. Green was Resident Engineer.

COLORFUL FLORAL FESTIVAL

Prior to the dedication ceremonies Governor Olson and his party attended an abalone luncheon at Russian Gulch, provided by the Fort Bragg Mendocino Farm Center, and at 1:30 attended the annual rhodo-

dendron festival. Governor Olson crowned Queen Dethel Quinmel, the ceremony and the royal party making a very colorful affair. After the Queen and her attendants were placed on and about the throne, President A. E. Johnston of the Mendocino Coast Chamber of Commerce introduced the Governor.

In his address Governor Olson extolled the beauties of the Mendocino coast section and dwelled on the necessity of having an adequate defense for the entire Pacific Coast, promising to do everything in his power to see that such adequate defenses were provided. He also stressed the necessity of adequate fire protection for the forests of California, calling attention to the appalling losses through fires and the necessity for more funds to combat this menace.

Following the Governor's address, C. V. Whited of Mendocino, introduced Secretary of State Paul Peek, who made a short speech, at the conclusion of which the Governor's party proceeded to the Russian Gulch Bridge where the Secretary of State cut the ribbon and the party proceeded across the structure on their way back to Sacramento.

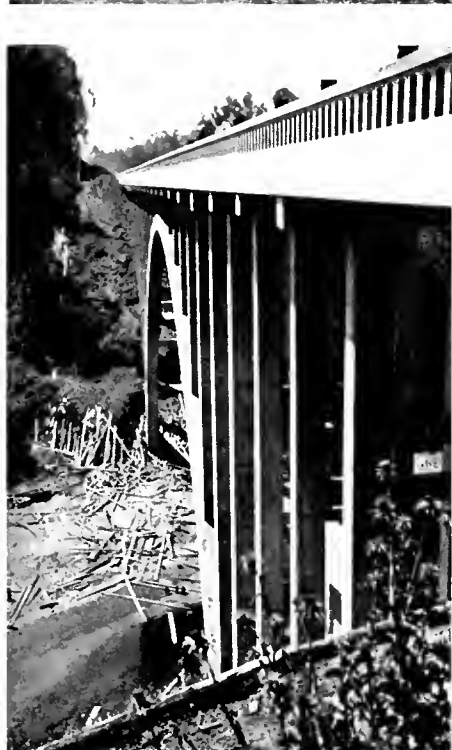
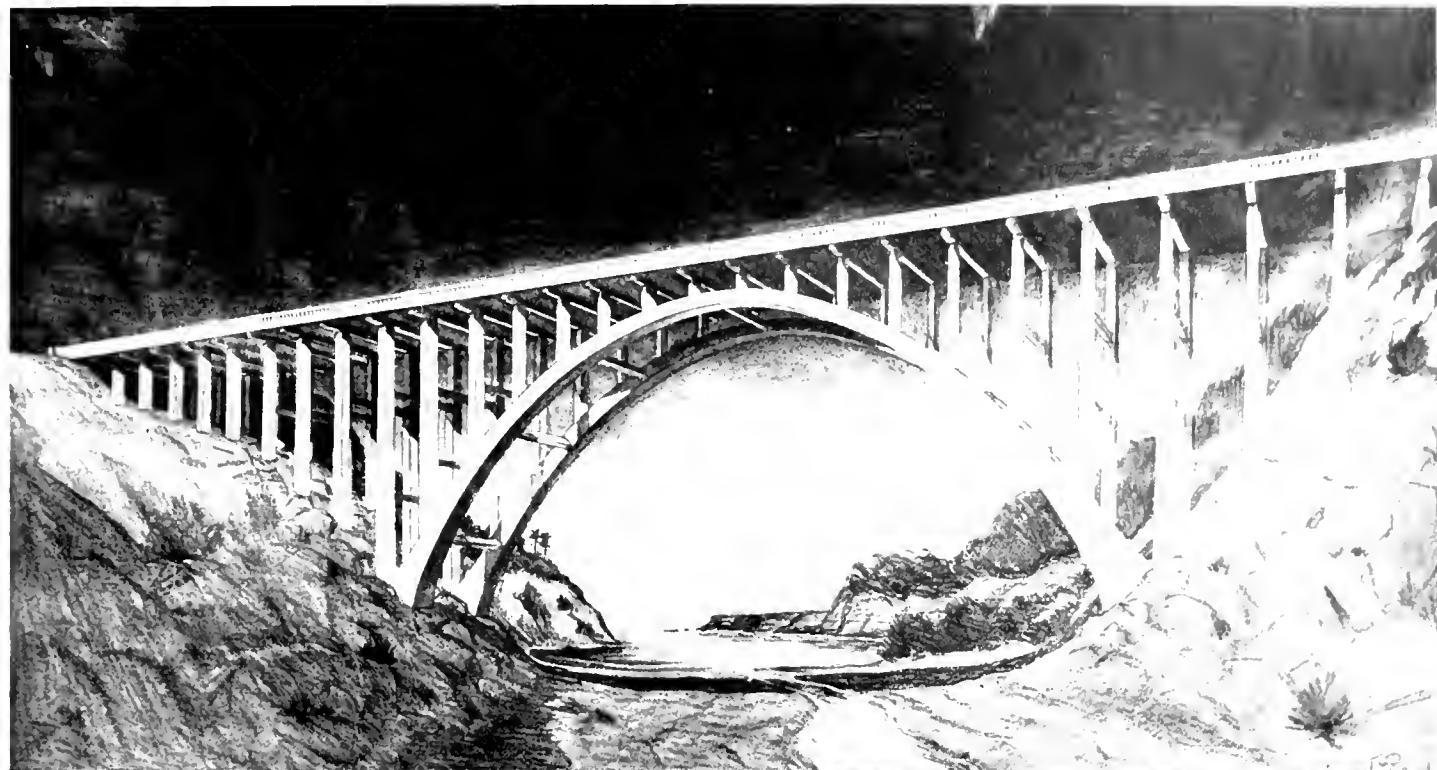
Cahuenga Freeway Unit Opened

(Continued from page 17)

The volume of traffic using Cahuenga Pass Boulevard is very large. On two Sunday traffic counts taken one year apart during July of 1938 and 1939 traffic passing the intersection of Cahuenga Boulevard and Lankershim Boulevard amounted to from 65,000 to 70,000 cars per day. This marks it as among the most heavily traveled highways or streets in the State. From the performance of the completed section under heavy traffic conditions, we are assured that even this vast number of cars will be able to easily and expeditiously pass over this modern freeway.

Policeman: "You've been speeding!"

Driver: "The brakes won't work, so I wanted to get home before I had an accident."



Russian Gulch Bridge, a graceful spandrel arch structure 526 feet, 9 inches long on the Mendocino Coast highway was dedicated June 9 when Secretary of State Paul Peek cut the ribbon. The old structure was a timber trestle built 30 years ago.

YOUNG BOYD TO GET REWARD

Anson Boyd, son of California's State Architect, is the lucky finder of a Radio-Meteorograph released by a U. S. Naval Station to determine the temperature of the air, moisture of the air, and also the heights in the air through which the instrument passed.

Young Boyd came upon the instrument on the shore of Mission Bay in Pacific Beach. He was embarked upon an early morning fishing expedition when he spied the peculiar looking box with its bright red silk parachute and burst balloon lying near the water's edge. He will receive a reward.

An Arkansas editor recently showed his genius when he wrote the following item for his paper:

"Miss Mary Blank, a Batesville belle of twenty summers, is visiting her twin brother, William, aged thirty-two." Cincinnati Enquirer.



Equipment at work on "Ducor Cut-off," a portion of the Orange Belt highway in Tulare County near Porterville.

Ducor Cut-off Link Completed

ANOTHER portion of the "Ducor Cut-Off" was completed by Contractor L. Biasotti & Son on June 1, 1940. This portion extends 3.1 miles from Thermal School to Ducor.

The "Ducor Cut-Off" is a relocation project, between Standard Oil Tank Farm, near Bakersfield, and Ducor, 12 miles southerly from Porterville in Tulare County, where it connects with State Highway 129. It will form a portion of the "Orange Belt highway" which traverses the Orange Belt at the easterly edge of the San Joaquin Valley and will shorten the distance between Bakersfield and Ducor some 5 miles.

When it is completed, traffic from Bakersfield or points further south and destined for the Orange Belt and General Grant Park, will leave U. S. 99 at a point near Standard Oil Tank Farm and travel almost due north to Ducor. Formerly this traffic left U. S. 99 at Famoso and followed Sign Route 65 through Rich Grove to Ducor. On this old road there were 6 right angle turns, generally indirect alignment, inferior sight distance due to sharply rolling gradients and two railroad crossings.

In contrast, the new route will

maintain exceptionally consistent direction, will have very light gradients and curvature, together with a minimum sight distance of 2300 feet and no railroad crossings.

On the "Cut-Off," in addition to the completion of this contract, two portions have been built by county forces in the counties of Kern and Tulare and the construction of a fourth section has recently been started in Kern County, south of Poso Creek, by Contractor George E. France.

On the section completed June 1, by Biasotti and Son, the excavation was made, for the greater part, with twelve- and fourteen cubic yard carry-all scrapers. A $\frac{3}{4}$ -cubic yard shovel was used in completing the long haul on a portion of the selected surfacing. A penetration treatment with SC-2 was applied to hold the surfacing under light traffic until such time as the completion of other sections of the route will call for a more permanent type of surfacing over the entire project. One of the interesting features of the work was the construction of sacked concrete riprap at White River Bridge. A mixer, supplying one-fourth cubic yard per batch delivered the concrete into a hopper,

at the bottom of which a hand-operated gate fed into a balanced measuring box, from which each sack was filled with exactly one cubic foot of the mixed concrete.

This control, together with the exercise of care in tying the filled sacks at a definite distance from the top of each sack, provided uniformity in size and flexibility of the sacked units. Thereafter care was exercised to make a uniform lap in laying a new layer of sacked concrete over the previous one and to break joints with the preceding layer. Five anchorage counterforts of sacked concrete were built back into the bank in the construction at each end of the bridge.

The people of Bakersfield and the towns along the Orange Belt hail the construction of this route with enthusiasm. The shortening of distance and the raising of standards of the highway are thoroughly appreciated.

The aggressive wife was hauling her husband over the coals for having made a fool of himself at a party. He sat in dejected silence—hands stuffed into his pockets.

"And don't be sitting there," she shouted, "making fists at me in your pockets, either!"
—The Tennessee Road Builder.



Views of the "Ducor Cut-off" recently completed in Tulare County: At top—Bridge under construction across the White River. At bottom—Looking northerly into big cut. This portion of the cutoff was constructed by Tulare County with county-owned equipment and shows neat slopes and roadbed.

Modernizing Highway System Would Pay Dividends

(Continued from page 9)

cheaper type of surface than is required. The result is increased maintenance and earlier replacement because of the shorter life of the less rugged type of construction. It leads to early obsolescence of the system and means we are faced with earlier reconstruction.

MULTI-LANE ROADS

3—Modernization must also mean increasing the capacity of our heavy traffic arteries by the building of multi-lane roads. At the date of this report there are about 758 miles of our system which should be at least four lanes in width to properly accommodate traffic volume. In addition, many miles of our present two-lane roads would provide safer operation and more comfortable travel if they could be widened immediately to at least three lanes. At the present time there are only about 150 miles of four-lane and six-lane divided roadways in the State Highway System. This mileage will have to be increased considerably, although in round figures one might estimate that only about five to ten per cent of the total system will ever require such extensive improvement.

4—Modernization also means improvement of alignment and grade to provide safe sight distance for safer operation.

There are 8062 locations on major State highways in the Federal Aid System alone in this State presenting a condition where sight distance is less than required for safe passing and 4645 locations where even a safe stopping distance is lacking.

A new concept of design is introduced by this feature of slight distance. It calls for frequent installation of safe passing sections and the shortening of the nonpassing sections. It means that on all these latter there should be a safe stopping distance.

INADEQUATE BRIDGES

5—Modernization also means the construction or reconstruction of inadequate bridges—those inadequate for legal loads as well as those inadequate as to width. Some 1659 bridges have less than 24-foot width of roadway where adjacent pavements are 20 feet wide. Some 400 bridges are

now posted for less than legal load limits or restrictions in speed.

The Planning Survey tells us that at the present time we are falling behind at the rate of 38 bridges per year in our replacement program. It probably is not necessary to point out that a restriction in the legal load limit on a bridge immediately imposes on the entire route of which it is a part a limitation which is bound to prove uneconomical to commercial traffic using the highway.

6—Modernization must also provide for the construction of 256 miles of legally designated State highway routes where no traversable road now exists but which are nevertheless a definite obligation.

GRADE SEPARATIONS

7—It means elimination of more of our railroad grade crossings. Although we have 625 on the State highway system we will have plenty to do if we can confine our activities to only those where heavy traffic exists.

8—Modernization means separating the grades of important intersecting roads at heavily traveled intersections. Separation prevents loss of time and operating expense and materially reduces physical hazard, although we must not forget that such separations are expensive. For safety's sake we can, temporarily at least, design and build channelized intersections at grade and we can and should acquire the right of way necessary for ultimate separation before costly developments and improvements make the expense prohibitive.

9—Modernization means the construction of freeways on some of our major routes especially adjacent to and leading into our larger metropolitan areas. The application of this principle to these important roads is imperative, if the integrity, capacity and purpose of our major traffic arteries are to be preserved.

The rapid development of abutting property into ribbon towns destroys the integrity of the highway in a short time. The motorist who pays the bill is confronted with a heavy loss on his investment. It should be protected. The freeway offers a means for relief from congestion and attendant hazard.

The present mileage in our highway system is 13,605.5 miles. Its condition may be summarized as follows:

Condition	Mileage	Per Cent
Unimproved and unsealed roads	530.0	3.9
Oiled earth—Almost entirely substandard	3,588.0	26.4
Graveled roads—Light oil surface	1,516.0	11.1
Intermediate type surfaces	3,303.0	24.3
High type pavements, some of which are adequate, much of which is obsolete	4,076.0	30.0
Bridges, some of which are adequate, many of which are structurally weak or inadequate	87.5	0.6
Mileage within incorporated areas, not included in above, both adequate and inadequate in type	505.0	3.7
TOTAL	13,605.5	100.0%

The mileage requiring modernization is as follows:

Description	Mileage	Per Cent of Total
Present mileage requiring new construction, reconstruction, widening, resurfacing, etc.	10,640	78.2
New "Freeway" construction required to adequately serve present traffic	60	0.4
Miscellaneous bridges, railroad and highway separation structures, etc., not included with above.		

The financial requirements to modernize the present mileage are estimated as follows:

Description	Amount	Per Cent
Estimated cost of new construction, reconstruction, widening, resurfacing, etc., for 10,640 miles of highway to improve modern standards	\$407,133,200	78.0
Estimated cost of constructing new "Freeways"	36,000,000	6.9
Estimated cost building, widening, or replacing bridges and railroad or highway grade separations	65,767,000	12.6
Estimated cost of sea shore protection, safety devices, and miscellaneous work not included in above	3,110,000	0.6
Partial estimated cost of Right of Way (Only few Districts estimated this item)	9,975,000	1.9

Total estimated cost ----- **\$521,985,200** **100%**

MODERNIZING COST LARGE

The foregoing brief discussion outlines the principal requirements which must be met if we are to modernize our State highway transportation system. It constitutes the basis for the estimates of cost which have been prepared in tabulations accompanying this discussion.

The bill looks large. It is large. However, I will venture to predict right now that the motor vehicle user will probably pay more in operating cost, including physical and property damage, during the next 25 years, if he has to operate over the present

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State Acquires Beaches, Lake and Island

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with the extra areas to ocean frontage, we were able to complete negotiations at reasonable prices.

The following areas, comprising about 69 acres, were acquired from owners who were willing to cooperate, and are now publicly owned:

Near Lake Lucerne, Arroyo de las Frijoles (Bean Hollow) containing a small lake and a beautiful flat, sandy beach extending for nearly a quarter of a mile along the ocean front. Pebble Beach, while small, is a particularly attractive spot, containing varicolored pebbles, constantly changing with the whims of the tides and up to now highly coveted by builders and art lovers for home decoration purposes.

Parts of Pescadero and San Gregorio beaches, which have been obtained, afford places for bathing, fishing, picnics and other recreational purposes. In addition, there has been acquired a small island a short distance from the shore and numerous small beaches, coves and lookout points along the rugged coastline. The preservation of this seaside playground will be sincerely appreciated as time goes on and other beach areas are lost to the public.

These parcels do not include all of the lands it was thought desirable to include in this park area, but for various reasons negotiations with the owners of the remainder of the areas were unsuccessful.

San Mateo County will take title to these areas which were acquired for it by the State of California under an agreement requiring that they be devoted exclusively to public park and recreational purposes. In this manner it has been possible to preserve this coastal region in all its beauty. The county reimbursed the State for the actual cost of acquisition of the areas involved.

The highway construction is planned with flat rounded slopes, adapted to growth of native cover, to merge into and become a part of the terrain. Curves and grades also fit naturally into the picture.

Bay Bridge Traffic for June Again Breaks All Records

JUNE traffic on the San Francisco-Oakland Bay Bridge reached another record-shattering total of 1,364,941 vehicles. This was achieved in spite of a short month and a serious curtailment of truck traffic due to a teamsters' strike in Oakland and other East Bay cities.

The increase of traffic over June of 1939 was 476,546 vehicles, or 53.6 per cent. However, the total revenue collected dropped \$1,750.

A year ago the Treasure Island traffic amounted to 157,385 vehicles, while this June it was 220,031. This was an increase of 40 per cent.

There appears to be no question now but that the reduction in bridge tolls has reached a point well past

the "point of diminishing returns." The average toll in June, 1939, was 49.8 cents, while this June it was only 32.3 cents, a reduction of 35 per cent. In spite of a tremendous growth in traffic there was a small decrease in money collected.

The abandonment of auto ferry service in May of this year was instrumental in creating a large share of the traffic increase. Had the ferries continued to operate and handle the same number of vehicles this June as last, the bridge revenue would have actually dropped about \$85,000, or 20 per cent.

June traffic on the San Francisco-Oakland Bay Bridge and comparative figures are:

	June 1940	June 1939	May 1940	Total Since Opening
Passenger autos and auto trailers -----	1,258,403	803,846	1,093,789	33,318,319
Motorcycles and Tricars----	4,681	3,995	4,513	151,155
Buses -----	25,528	16,169	21,866	556,155
Trucks and truck trailers--	57,174	47,735	61,874	1,616,722
Others -----	19,155	16,650	20,535	569,932
Total vehicles -----	1,364,941	888,395	1,202,577	36,212,283

Super-Highway to Break San Rafael Bottleneck

(Continued from page 8)

parabolic curves. These will provide a pleasing appearance from the side.

Included in the contract for the viaduct and located opposite is the construction of a triangular-shaped structure at Irwin Street at the point where Irwin Street crosses the San Rafael Harbor. This will be of reinforced concrete girder type founded on precast concrete piles. The contract has been awarded to the Heafey-Moore Company, Fredrickson & Watson Construction Company at a bid price of \$380,999.10.

Construction of this section is proceeding at a rapid pace and with reasonable weather it will probably be open to traffic late this fall, substituting miles of easy curves, wide, smooth roadbed for the weary, twisting present route.

Modernizing Highway System

(Continued from page 24)

inadequate system, than it will cost him to modernize, at the figures shown in these tabulations. It will have to be done eventually—why pay the bill twice? Once in operation cost and once in construction cost.

We have in this current biennium approximately \$30,000,000 for construction—that's \$15,000,000 a year. Suppose we raise it to \$20,000,000 a year. It would then take us 25 years to accomplish the necessary improvements which are needed so vitally right now. It should be obvious to all that further procrastination and delay can only result in annual increase of maintenance, which in turn decreases the amount available for construction, plus a constantly increasing hazard and loss of time as traffic continues to grow.

Small Damage to State Highways By Imperial Valley Earthquake

By E. E. WALLACE, District Engineer

IMPERIAL Valley experienced a severe earthquake on Saturday, May 18, 1940, at 8:37 p.m. The main shock was preceded by two light shocks on Friday and was followed by a series of severe shocks through the night, tapering off with some twenty-five lighter shocks until Sunday noon. The earthquake was the heaviest experienced in Imperial Valley and resulted in much property damage, together with loss of nine lives and several injuries.

Greater loss of life was avoided only because of the fact that the collapse of buildings occurred after the first severe shock and the population had evacuated the buildings and were camped on lawns and in the streets.

A very distinct movement occurred along the extension of the San Andreas fault line and the faulting was in the form of a pressure rift, leaving quite evident surface indications from Brawley to a point some 20 miles below the Mexican border.

Despite the large surface movement comparatively little damage was done to the State Highway System either where the fault line directly crossed the highway routes or developed in close proximity to them.

The vertical displacement near the border approximated three feet, and surveys which have just been completed on Highway Route 202 east of Calexico, where the fault crossed the State Secondary Highway, indicate horizontal movement several miles in length with the easterly side of the fault shifting south and the westerly side shifting to the north. The north movement was apparently somewhat less than the south movement, and the total horizontal shift at the highway crossing was 9.9 inches. The vertical movement at the same location was 1.6 inches, most of which appears to be an upheaval on the westerly side of the fault line extending several miles to the west.

The fault crossed State Route 12 between Holtville and El Centro,

\$77,000 Allotment for Alamo Canal Damage

As a result of the application to Governor Culbert L. Olson by the Imperial Irrigation District of Imperial County for financial assistance in repairing the earthquake damage done to the Alamo Canal, through which water from the Colorado River is supplied to the district, Director of Public Works Frank W. Clark has recommended to the Director of Finance that an emergency allotment of \$77,000 be made from the State Emergency Fund.

The conditions of the proposed allocation are that a contract be made between the Department of Public Works and the Imperial Irrigation District to provide among other things that the State expenditures shall not exceed one-half of the total cost of said work and in no event exceed \$75,000.

Based upon investigations by State Engineer Edward Hyatt, it is estimated that the actual field cost of repair and rehabilitation of the irrigation works in Mexico and California within the jurisdiction of the district will total \$150,000 and the cost of State administration and supervision will aggregate \$2,000.

where a 16-inch horizontal movement occurred in the pavement, with approximately a 6-inch vertical displacement and an apparent increase in length of 14 inches.

L. J. Foster, construction engineer for the All-American Canal, at Yuma, advised that their surveys were not as yet completed but that the movement at the fault crossing the All-Amer-

ican Canal near the Mexican Border amounted to a net movement of between 14 and 15 feet, with the ground on the east side of the fault moving south and that on the west side moving north. The north movement was in all cases apparently less than the south movement.

Much damage occurred to buildings in El Centro, Holtville, Imperial and Brawley, with far greater damage in Brawley than in any of the other cities of the valley.

The chief damage to the highway occurred at the New River bridge just west of Brawley, where the timber caps were shoved entirely off of the piles, allowing the floor of the structure to sag and requiring diversion of traffic for approximately one week while repairs were made. The approach to this bridge settled approximately 18 inches.

Considerable crushing and buckling of pavement occurred each side of the fault line wherever the highway was crossed. At other locations through the valley the concrete pavement was raised at the joints, causing unevenness and roughness of the pavement, particularly south of Brawley on Route 26.

Heavy damage resulted to the canal systems throughout Imperial Valley and on the main canals in Mexico, through which the water is brought into the valley. Serious damage to crops was avoided by utilizing completed portions of the All-American Canal to carry water to the westerly side of the valley.

Reconstruction work in all the cities is well under way and many of the buildings have been reoccupied.

Man chanding over his pay envelope to his wife: "You got a nice increase this week, dear."—The Recorder.

Mrs. Green: "Why don't you ask your husband's advice on the matter?"

Mrs. Brown: "I intend to as soon as I've decided what to do."—California Cultivator.



Pictures of earthquake damage to the State highway system in Imperial County. No. 1—Settlement of 18 inches in the approach to New River bridge. No. 2—Pavement shattered west of Brawley. No. 3—Pavement cracked east of Ash Canal. No. 4—Sixteen-inch offset in pavement on Route 27. No. 5—Timber piles shoved from beneath caps of New River bridge. No. 6—Horizontal shift of nine feet where fault line crosses Route 202.

Highway Bids and Awards for the Month of June, 1940

AMADOR COUNTY—Between one mile south of Jackson Creek and two miles south of Loma, about 3.8 miles to be graded and surfaced with plant-mixed surfacing on gravel base. District X, Route 97, Section A. Caputo and Keeble, San Jose, \$89,305; A. Teichert & Son, Inc., Sacramento, \$101,132; Hemstreet and Bell, Marysville, \$104,831; M. J. B. Construction Co., Stockton, \$108,190; Marshall S. Hanrahan, Redwood City, \$134,430. Contract awarded to Fredericksen & Westbrook, Sacramento, \$87,908.

CALAVERAS COUNTY—0.8 mile to be graded and surfaced with plant-mixed surfacing between 1.7 and 2.5 miles east of Valley Springs. District X, Route 24, Section B. M. J. B. Construction Co., Stockton, \$9,862; Piazza and Huntley, San Jose, \$11,003. Contract awarded to Louis Biasotti & Son, Stockton, \$9,691.

DEL NORTE COUNTY—Redecking existing bridge across Smith River about eight miles east of Crescent City. District I, Route 1, Section C. E. E. Smith, Eureka, \$16,364; Joseph Shaw, Crescent City, \$16,654; C. C. Gildersleeve, Berkeley, \$16,988; Fred J. Maier & Son, Eureka, \$18,246; A. Soda & Son, Oakland, \$19,979; Scheumann & Johnson, Eureka, \$21,625. Contract awarded to F. Fredenburg, South San Francisco, \$16,355.

FRESNO COUNTY—Across Byrd Slough 19 miles east of Fresno, a concrete slab timber bridge. District VI, Route 41, Section S. James E. Anderson, Visalia, \$7,595; Geo. M. Carr, Santa Rosa, \$8,160; Valley Construction Co., San Jose, \$8,715; E. G. Perham, Los Angeles, \$9,004; A. S. Vinnell Co., Alhambra, \$9,157; Lindgren & Swinerton, Inc., Sacramento, \$10,405; C. C. Gildersleeve, Berkeley, \$10,873. Contract awarded to F. Fredenburg, San Francisco, \$7,245.

HUMBOLDT COUNTY—Between Scotia and one mile north of Rio Dell, about 1.0 mile to be graded and surfaced with plant-mixed surfacing. District I, Route 1, Section E. Contract awarded to A. Soda and Son, Oakland, \$52,582.

INYO COUNTY—Between 1.7 and 6.7 miles south of Shoshone, about 5 miles to be graded and road-mixed surface treatment to be applied. District IX, Route 127, Section P. F. Gunner Gramatky, Pasadena, \$29,979; C. G. Willis & Sons Inc. and Chas. G. Willis, Los Angeles, \$12,924; A. S. Vinnell Co., Alhambra, \$15,789; Basich Bros., Torrance, \$16,631; Isbell Construction Co., Reno, Nev., \$48,092. Contract awarded to Roland T. Reynolds, Anaheim, \$36,664.

KERN COUNTY—Between Rosamond and Mojave, 7.8 miles seal coat. District IX, Route 23, Section A. A. S. Vinnell Co., Alhambra, \$5,456; G. W. Ellis, North Hollywood, \$5,973; Goode & Schroeder, Inc., Roscoe, \$6,561. Contract awarded to Basich Bros., Torrance, \$4,903.

LOS ANGELES COUNTY—An undercrossing to be constructed under the tracks of the Pacific Electric Railway Co. and Fair Oaks Ave. in South Pasadena and the grading of a portion of Arroyo Seco Parkway and the paving of the approaches to the structure with asphalt concrete. District VII, Route 205, South Pasadena. Oberg Bros., Los Angeles, \$46,929; R. R. Bishop, Long Beach, \$47,177; J. S. Metzger & Son, Los Angeles, \$47,607; Byerts & Dunn, Los Angeles, \$47,856; Oscar Oberg, Los Angeles, \$48,222; Harry F. Miller, Los Angeles, \$48,622; Chas. J. Dorfman, Los Angeles, \$48,739; Griffith Co., Los Angeles, \$49,763; J. E. Haddock, Ltd., Pasadena, \$50,020; Dim-

mitt & Taylor, Los Angeles, \$52,062; Baruch Corp., Los Angeles, \$52,960. Contract awarded to Carlo Bongiovanni, Los Angeles, \$46,502.

MADERA COUNTY—Between Arcata School and Madera, about 3.1 miles to be graded and surfaced with asphalt concrete and plant-mixed surfacing, a new reinforced concrete bridge to be constructed and an existing reinforced concrete bridge to be raised and lengthened. District VI, Route 4, Section A. Griffith Co., Los Angeles, \$169,239; Union Paving Co., San Francisco, \$184,885; Marshall S. Hanrahan, Redwood City, \$202,837; A. Teichert & Son, Inc., Sacramento, \$205,441. Contract awarded to Piazza and Huntley & Trewitt Shields and Fisher, San Jose, \$165,702.

MARIN COUNTY—In the city of San Rafael, a reinforced concrete viaduct having a length of 2207 feet 6 inches to be constructed. District IV, Route 1, Section S.Rf. Earl W. Heple, San Jose, \$392,772; Campbell Construction Co., Sacramento, \$402,378; Andy Sordal and R. R. Bishop, Long Beach, \$409,140; United Concrete Pipe Corp., Los Angeles, \$425,165; MacDonald & Kahn, Inc., San Francisco, \$429,256; Chas. L. Harney, San Francisco, \$447,792; Clinton Construction Co. of California, San Francisco, \$457,403; L. E. Dixon Co., Los Angeles, \$468,818; The Utah Construction Co., San Francisco, \$531,884; Engineers, Ltd., Sacramento, \$563,144. Contract awarded to Heafey-Moore Co. & Fredericksen & Watson Construction Co., Oakland, \$380,999.

MENDOCINO AND LAKE COUNTIES—At various locations, about 32.1 miles of road-mix surfacing and seal coat to be applied. District I, Routes 1, 15, and 48. E. E. Smith, Eureka, \$79,955; Independent Construction Co., Ltd., Oakland, \$83,791; E. A. Forde, San Anselmo, \$87,476. Contract awarded to Oranges Bros. Const. Dept., Stockton, \$74,398.

NEVADA COUNTY—Between Donner Summit and two miles easterly, about 0.9 mile to be graded, surfaced with premixed bituminous treated surfacing and seal coat applied. District III, Route 37, Section C. Contract awarded to Fredericksen & Westbrook, Sacramento, \$34,974.

ORANGE COUNTY—Between San Juan Capistrano and $\frac{1}{2}$ mile easterly, about 0.5 mile to be graded and surfaced with plant-mixed surfacing. District VII, Route 64, Section A. C. R. Butterfield & Kennedy Co., San Pedro, \$22,478; V. R. Dennis Construction Co., San Diego, \$22,865; Denni Investment Corp., Wilmington, \$22,907; Dimmitt & Taylor, Los Angeles, \$23,316; J. E. Haddock, Ltd., Pasadena, \$23,803; Oswald Bros., Los Angeles, \$26,194; J. S. Metzger & Son, Los Angeles, \$26,493; Sully Miller Contracting Co., Long Beach, \$26,953. Contract awarded to A. S. Vinnell Co., Alhambra, \$21,884.

PLACER COUNTY—Between Rock Creek and Nevada County line, about 1.3 miles crushed rock borders to be constructed and new borders and existing surfacing to be surfaced with plant-mixed surfacing. District III, Route 17, Section C. Contract awarded to Hemstreet and Bell, Marysville, \$9,632.

SAN DIEGO COUNTY—Across Sweetwater River at Bonita, a reinforced concrete slab bridge having a length of 609.5 feet to be constructed. District XI, Feeder route. Daley Corp., San Diego, \$10,806; R. R. Bishop, Long Beach, \$39,177; The Contracting Engineers Co., Los Angeles, \$41,352; M. H. Golden, San Diego, \$42,083; Bernard G. Carroll and Harry L. Foster, San Diego,

\$38,955; V. R. Dennis Construction Co., San Diego, \$38,736; J. S. Metzger & Son, Los Angeles, \$39,845; Griffith Co., Los Angeles, \$40,525; A. L. Gabrielson, Arlington, \$36,678; Byerts & Dunn, Los Angeles, \$40,324. Contract awarded to Oberg Bros., Los Angeles, \$34,308.

SANTA CLARA COUNTY—At El Camino Real and University Ave. in Palo Alto, about 0.4 mile to be graded and paved with asphalt concrete and Portland cement concrete. District IV, Route 2, Section A. P.A. Earl W. Heple, San Jose, \$96,381; Heafey-Moore Co. & Fredericksen & Watson Construction Co., Oakland, \$99,926; A. G. Raich, San Francisco, \$101,280; Paul J. Tyler, Oroville, \$126,959. Contract awarded to Union Paving Co., San Francisco, \$93,635.

SONOMA COUNTY—At McClellan Gulch, about 29 miles north of Jenner, about 0.4 mile to be graded and penetration oil treatment to be applied. District IV, Route 56, Section D. Guerin Bros., San Francisco, \$25,490; J. L. Conner and Sons, Point Arena, \$32,589. Contract awarded to James E. Anderson, Visalia, \$22,034.

TRINITY, SHASTA, TEHAMA, LASSEN, PLUMAS AND MODOC COUNTIES—At various locations, about 50.6 miles of seal coat to be applied. District II, Routes 20, 28, 29, 86, 21, 83. J. A. Casson Co., Hayward, \$43,838. Contract awarded to C. F. Fredericksen & Sons, Lower Lake, \$37,708.

TULARE COUNTY—Between Highway School and Visalia, about 1.0 mile to be graded and surfaced with asphalt concrete. District VI, Route 10, Section B. Louis Biasotti & Sons, Stockton, \$86,232; Union Paving Co., San Francisco, \$91,632; Denni Investment Corp., Wilmington, \$96,763. Contract awarded to Piazza and Huntley, San Jose, \$79,505.

YUBA AND BUTTE COUNTIES—Across Homent Creeks about 1.2 miles to be graded and surfaced with crusher run base and plant-mixed surfacing and three reinforced concrete slab span bridges on concrete pile bents to be constructed. District III, Route 87, Sections A.A. Hemstreet and Bell, Marysville, \$124,833; Heafey-Moore Co. & Fredericksen & Watson Construction Co., Oakland, \$134,712; M. J. B. Construction Co., Stockton, \$136,021; A. Teichert & Son, Inc., Sacramento, \$136,796. Contract awarded to Engineers, Ltd., & Parrish Bros., Sacramento, \$119,898.

Engineers Organize Class

(Continued from page 19)

with unit cost of each type into a chart.

The men of the different departments were grouped with a Bridge Department man acting as captain to bring together different viewpoints.

Through cooperation of the C. S. E. A. committee on education and its member in charge of engineering subjects, L. C. Hollister, design engineer for the Bridge Department, arrangements were made for stenographic service to permit the issuance of mimeographed syllabus notes to class members for each week of the course.

State of California

CULBERT L. OLSON, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

FRANK W. CLARK, Director of Public Works

FRANZ R. SACHSE, Assistant Director

MORGAN KEATON, Deputy Director

CALIFORNIA HIGHWAY COMMISSION

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J. G. STANDLEY, Principal Assistant Engineer
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T. H. DENNIS, Maintenance Engineer
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L. V. CAMPBELL, Engineer of City and Cooperative Projects
R. H. STALNAKER, Equipment Engineer
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CHARLES H. WHITMORE, District III, Marysville
JNO. H. SKEGGS, District IV, San Francisco
L. H. GIBSON, District V, San Luis Obispo
E. T. SCOTT, District VI, Fresno
S. V. CORTELYOU, District VII, Los Angeles
E. Q. SULLIVAN, District VIII, San Bernardino
S. W. LOWDEN (Acting), District IX, Bishop
R. E. PIERCE, District X, Stockton
E. E. WALLACE, District XI, San Diego

SAN FRANCISCO-OAKLAND BAY BRIDGE

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HAROLD CONKLING, Deputy in Charge Water Rights
A. D. EDMONSTON, Deputy in Charge Water Resources Investigation
R. L. JONES, Deputy in Charge Flood Control and Reclamation
GEORGE W. HAWLEY, Deputy in Charge Dams
SPENCER BURROUGHS, Attorney
GORDON ZANDER, Adjudication, Water Distribution

DIVISION OF ARCHITECTURE

ANSON BOYD, State Architect
W. K. DANIELS, Assistant State Architect
P. T. POAGE, Assistant State Architect


HEADQUARTERS

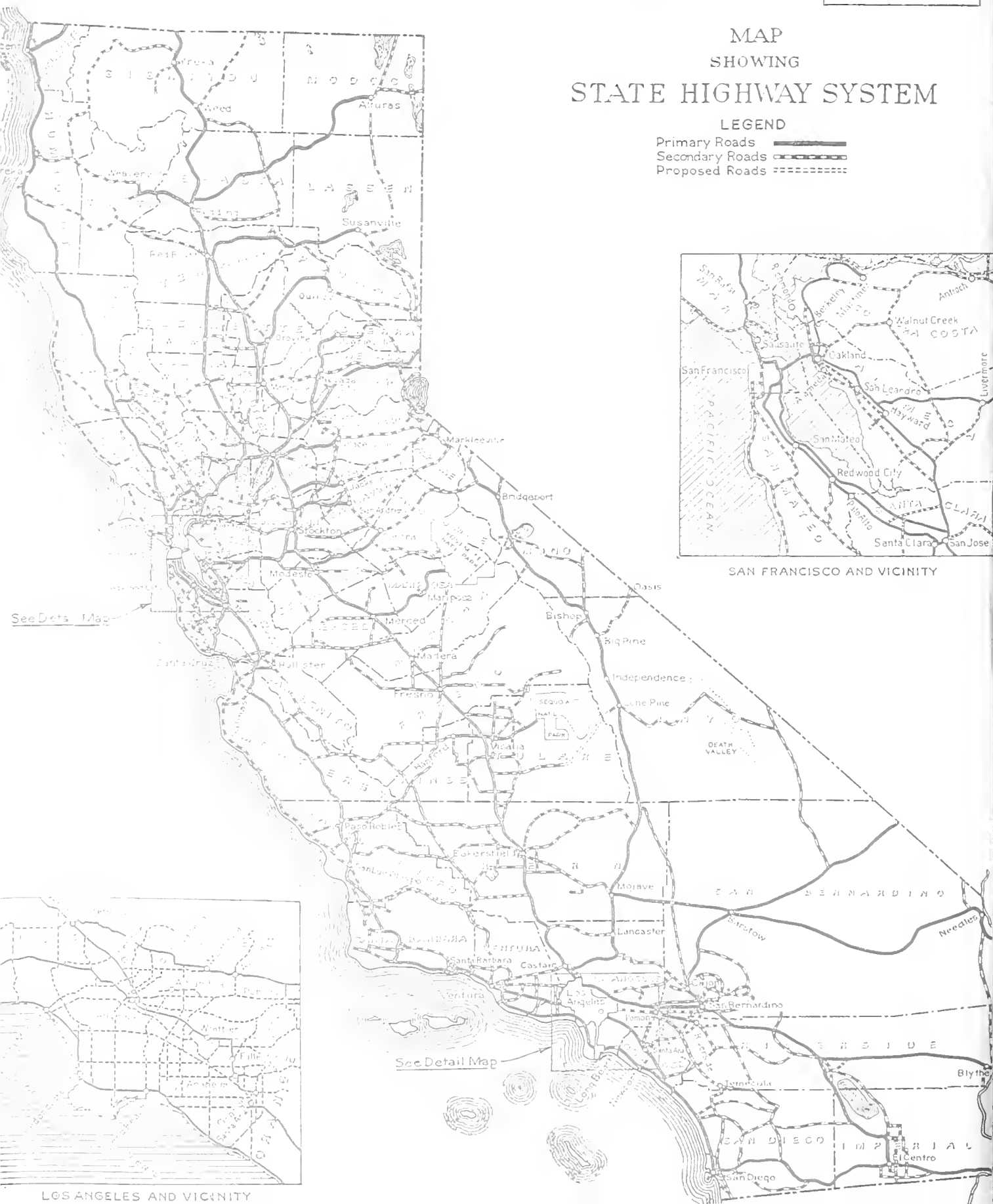
H. W. DEHAVEN, Supervising Architectural Draftsman
C. H. KROMER, Principal Structural Engineer
CARLETON PIERSON, Supervising Specification Writer
J. W. DUTTON, Principal Engineer, General Construction
W. H. ROCKINGHAM, Principal Mechanical and Electrical Engineer
C. E. BERG, Supervising Estimator of Building Construction

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C. C. CARLETON, Chief
PHIL F. GARVEY, Assistant Chief
FRANK B. DURKEE, Attorney
C. R. MONTGOMERY, Attorney
ROBERT E. REED, Attorney



Primary Roads
Secondary Roads
Proposed Roads 



CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



RUGGED SCENERY ON NEW ECHO SUMMIT RELOCATED
OVER THE SIERRA NEVADA MOUNTAINS
(SEE ARTICLE IN THIS ISSUE)

AUGUST
1940

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California

FRANK W. CLARK, Director

C. H. PURCELL, State Highway Engineer

J. W. HOWE, Editor

K. C. ADAMS, Associate Editor

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AUGUST, 1940

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State-Federal Meeting Called To Consider Problems Vital To Central Valley Power Market

By FRANK W. CLARK

Chairman California Water Project Authority

OF PARAMOUNT importance to every section of the Central Valley and the future of the Central Valley Project, is the forthcoming conference between the Water Project Authority of the State of California and representatives of the United States Bureau of Reclamation. It is tentatively planned that the meeting will be held in the California Commission conference room on Treasure Island the last week in August.

The conference was called by Secretary of the Interior Harold L. Ickes in response to two resolutions from the Authority and a letter from Governor Culbert L. Olson asking for a clearer understanding between the State and Federal agencies in connection with the distribution of water and power developed by the Central Valley Project.

AUTHORITY REQUESTS CONTRACT

The Authority specifically asked:

1. That a contract be negotiated between the State and Federal governments defining the policies and practices of the United States relating to the distribution of Central Valley Project water and power, and specifying the functions and duties of both agencies.

2. The proposed plan of operation of Shasta Reservoir and power plant; the amount and characteristics of the electric power output; its cost; the area to be served and the facilities which will be provided by the Federal government for the transmission and distribution of this power.

Clarification of these points will be of inestimable value to the Water Project Authority and to public utility districts contemplating the



GOV. CULBERT L. OLSON

public distribution of water and power from the project. It will also provide an adequate basis for a State program to be presented to the legislature.

As chairman of the Water Project Authority I believe the forthcoming joint conference will prove a definite step forward in the administration's program of assisting municipalities and other public agencies to place themselves in a position to bid for Shasta dam power.

We anticipate that this conference will further to a great extent the program of Governor Olson to bring about public distribution and sale of Shasta dam power—a program for which the Governor has fought vigorously and consistently.

In letters to Governor Olson and the writer accepting the proposal for a conference, Secretary Ickes stressed the importance of cooperative endeavor on the part of the State and Federal governments in the public distribution of Central Valley power. He wrote:

"I am hopeful that through this meeting the Department of the Interior and the State of California may find firmer ground for cooperative endeavor to the end that the great power resource of the Central Valley Project may be made to serve, through publicly owned outlets, the best interests of the people on the widest possible basis."

STATE HAS RESPONSIBILITY

Secretary Ickes also pointed out that the State has a definite responsibility in connection with the project and should prepare itself to discharge this responsibility.

"I have, and will continue to encourage the State to help us in this matter," he wrote.

In connection with the preference which will be given to public agencies in the sale of Shasta power, Ickes declared:

"I am not overlooking the fact that the Reclamation Project Act of 1939 said, with reference to disposition of power generated at Federal irrigation dams, 'that in said sales or leases preference shall be given to municipalities and other public corporations or agencies; and also to cooperatives and other non-profit organizations financed in whole or in part by loans made pursuant to the Rural Electrification Act of 1936 and any amendments thereof.'"

Secretary Ickes repeatedly has emphasized the interest of the Fed-

eral government in the public distribution of power from the Central Valley Project. It is anticipated that the joint meeting will develop a basis on which such a program can be immediately and effectively inaugurated.

Up to the present time the efforts of the State, under the direction of Governor Olson, to develop a program of public distribution of water and power from the Central Valley Project have failed largely because of the lack of enabling legislation.

While no opposition has been met with regard to the public distribution of water from the project, the power interests have bitterly fought the project—particularly its power features—from its inception and have been instrumental in twice defeating legislation which would have placed the State in a position to assist municipalities and other public agencies in providing public outlets for Shasta Dam power.

OBSTACLE TO DEVELOPMENT

The Authority has also been handicapped by the absence of any definite understanding with the United States Bureau of Reclamation as to the operation of the project when it is completed. This coming conference, at which this matter will be one of the important problems discussed, therefore may result in the elimination of the greatest obstacle to the rapid development of a public market for Central Valley Project facilities.

I have accordingly directed that all State data on possible methods of operation of Shasta Reservoir be assembled for correlation with similar data which have been compiled by the Bureau of Reclamation under the direction of Reclamation Commissioner John C. Page.

MEETING PLACE SUGGESTED

At the last meeting of the Water Project Authority it was decided that an immediate reply be sent to Secretary Ickes informing him of the steps which the Authority is taking in preparation for the conference and suggesting that it be held sometime during the last week in August on Treasure Island.

The State is eager to establish a sounder understanding with the Federal government in regard to the Central Valley Project and will cooperate fully to make the forthcoming conference a success. The

Ickes Letter To Director Clark

Department

of the
Interior

THE SECRETARY OF THE INTERIOR

Washington

July 3, 1940

Mr. Frank W. Clark,

Director, Department of Public Works,

808 State Building,

Los Angeles, California.

My dear Mr. Clark:

I have received your letter of June 21 and the copies of two resolutions adopted by the Water Project Authority on March 28, 1940, which it enclosed.

I have written to Governor Olson that we were accepting your proposal that representatives of the Department meet with the Authority. I have asked Commissioner Page to get together data now being compiled by the Bureau of Reclamation and to designate qualified members of his staff to confer with the Authority. He will write to you directly to arrange the conference when the material has been digested. He informs me that it might be possible to hold this meeting during the latter part of August.

In preparation for the meeting I suggest that the Authority should also bring together such information as it has in order that the discussions may be concretely to the point.

As I said in my letter to Governor Olson, I am not unmindful of the fact that the Reclamation Project Act of 1939 said, with reference to disposition of power generated at Federal irrigation dams, "that in said sales or leases preference shall be given to municipalities and other public corporations or agencies; and also to cooperatives and other non-profit organizations financed in whole or in part by loans made pursuant to the Rural Electrification Act of 1936 and any amendments thereof."

You are familiar, of course, with the attitude consistently maintained by the Department of the Interior and the Bureau of Reclamation, that the State has a responsibility in connection with the Central Valley Project and should prepare itself to discharge this responsibility. My letter to Governor Olson of January 18 went more specifically to this point.

I am sure that the conference will prove helpful both to the Bureau of Reclamation and to the Water Project Authority, and I am hopeful that a practicable plan may result by which the power to be generated by the Central Valley Project can be marketed to and distributed through public agencies.

Such of the information which the Authority has requested as is available will be given to you at the time of the conference. Whether negotiations can be entered looking toward a contract between the Authority and the United States will depend, I believe, on what the conference develops.

Sincerely yours,

(Signed) HAROLD L. ICKES
Secretary of the Interior.

meeting should result in the clarification of numerous problems which face both the State and Federal agencies and materially assist the

program of providing adequate outlets and a competitive market for Central Valley Project water and power.



Shasta Dam site ready for pouring. First bucket of concrete was lowered from head tower cable to spot marked by white arrow in center foreground. Arrow at left center points to power house site and flume excavations.

Three Central Valley Project Milestones

By EDWARD HYATT, State Engineer

JULY, 1940, will go down in the history of the construction of the Central Valley Project as an epochal month. Three major milestones in the construction progress were passed. They were:

Pouring of the first concrete at Shasta Dam at 10.02 a.m., on July 8th.

Throwing the switch which started the first test pumping on the Contra Costa Canal at 10.08 a.m. on July 8th.

Pouring of the first concrete at Friant Dam at 2.00 p.m., on July 29th.

These three highly significant events served again to bring to the attention of the people of California

the speed with which this great project is being pushed toward completion.

BRIEF SHASTA CEREMONY

Pouring of the first concrete at Shasta Dam was marked by a brief ceremony witnessed by State and Federal officials and several hundred spectators. At one minute before 10.00 a.m. a horn sounded and a little electric concrete train made the first of the hundreds of thousands of trips it will make around its circular track at the base of the 460 foot head tower on the west abutment of the dam. Quickly it dumped its load of eight cubic yards of concrete into a steel bucket which soared skyward and out across the Sacramento River Canyon on its history making trip along the steel strands of the cable system crossing over the dam site.

As gently as a bird coming to rest, the 22-ton load of steel and concrete settled into what is known as Block C of Row 38 in the base of the dam. In the control tower half a mile away, an operator pushed a lever opening the gate at the bottom of the bucket.

The great square bucket, relieved of its load of concrete, leaped high in the air as the stretched cables sprung back. The first concrete at Shasta Dam had been poured.

SPECTATORS GIVE CHEER

Ralph Lowry, construction engineer for the Bureau of Reclamation in charge of the Kennett Division of the Central Valley Project; William A. Johnson, President of the Pacific Constructors, Inc.; Frank T. Crowe, General Superintendent in Charge of Construction, and the writer stood by



F. S. Reclamation Bureau photo.

First bucket of concrete poured at Shasta Dam July 8 was greeted with cheers.

as a dozen muckers spread the grey concrete. High above, the spectators lining the edge of the dam site sent up a cheer. Crowe tossed three new dimes into the wet concrete for luck.

Two days later the contracting company announced that it had completed pouring on the first section of Block C—a block 50 feet square. As the first section was completed workmen began building forms for the pouring of concrete in a second section, and this work will be extended the full length of Row 38, a distance of 400 feet.

The blocks in Row 38 are alongside the diversion channel dug out along the bed of the Sacramento River, into which the river will be diverted sometime in August.

Pouring of the first concrete at Shasta Dam went off so smoothly and with such apparent lack of effort, spectators scarcely realized the stupendous amount of preparation necessary for this epochal event. Behind that first bucket of concrete lay the construction of a great cement manufacturing plant in Santa Clara County, which will furnish the 5,800,000 barrels of low-heat Portland cement to be used in the dam. Ten miles away, at Redding, a plant for processing the 10,000,000 tons of sand and gravel that will be used has been built and from that plant to the dam site the longest conveyor belt system

in the world is in operation, carrying these aggregates over rivers and mountains at the rate of 1,000 tons per hour.

The cableway system which is being used in placing the concrete, is a

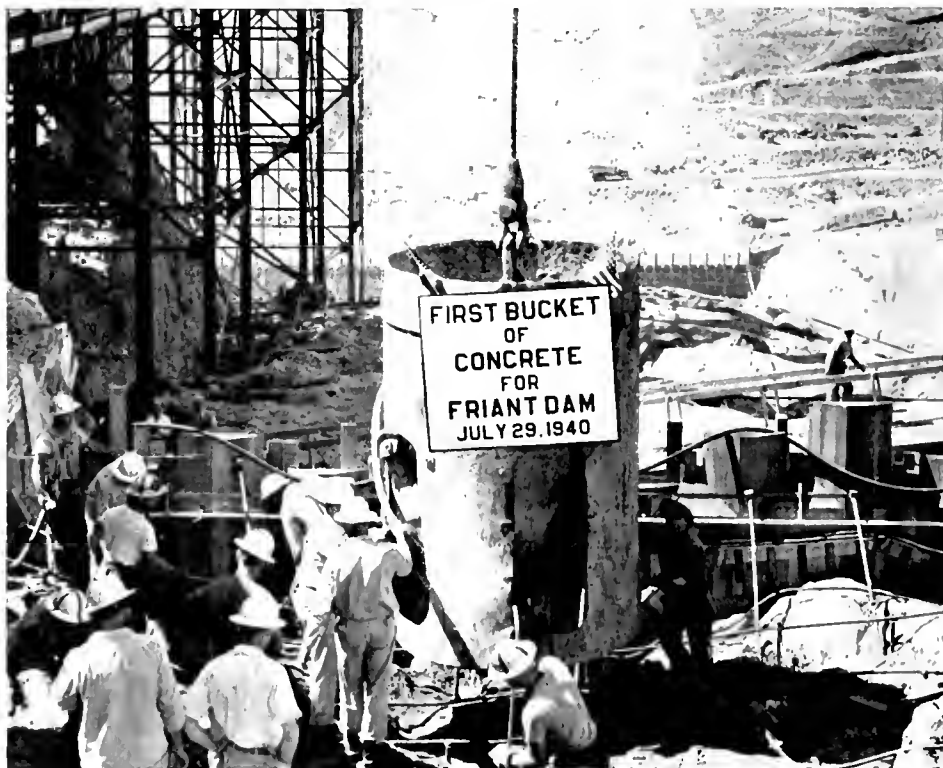
major engineering feat itself. The control tower rises 720 feet above the river. From it, cableways to seven movable tail towers will reach every portion of the dam. With the concrete mixing plant located at the bottom of the control tower, the system cost \$3,000,000.

INTRICATE MIXING SYSTEM

Giant stock bins, in which the aggregates are stored at Coram; a mile-long conveyor belt system to transfer them to the mixing plant; ten cement storage silos and a large pipe line from the silos to the mixing plant through which cement is forced by air pressure are part of the intricate system behind the pouring of concrete at Shasta Dam.

In the next four years enough concrete will be poured at Shasta Dam to build a modern two-lane highway from the dam site to Mexico City. The dam will be 560 feet high, 3,500 feet long and 580 feet wide at the base. It will rank as the second largest concrete dam in the world.

No ceremony marked the beginning of test pumping on the Contra Costa Canal, though by coincidence this important milestone in the construction of the canal occurred while muckers at Shasta Dam were still spreading the first bucket of concrete poured there.



First bucket at Friant occasioned a ceremonial celebration.



U. S. Reclamation Bureau Photo

"Twelve-toed Petes" are tail-towers supporting half-mile cables from the head tower at Shasta Dam. They move on 12 wheels at each lower corner of the tower on track rails.

Walker R. Young, supervising engineer in charge of field activities for United States Bureau of Reclamation, threw a switch that started a motor in Pumping Plant No. 1 near Oakley and the first water gushed into the concrete-lined canal from a tidewater section of the canal which extends to the pumping plant from Rock Slough.

Sometime in August the first twenty miles of the Contra Costa Canal will be placed in operation, delivering water to the City of Pittsburg and the Columbia Steel Company.

Except for the headworks, the first 20 miles of the canal, from the Rock Slough intake near Knightsen to a point three miles west of Pittsburg, are completed and this will be the first feature of the Central Valley Project actually placed in operation. Portions of the remaining 26 miles of canal extending from Pittsburg to Martinez are still under construction.

The regular water supply for the Contra Costa Canal will come from Shasta Reservoir and for that reason it can not be placed in normal operation until the dam is completed in

1944. Present operation is on an interim basis only. Pittsburg's municipal water system, including a treating plant recently completed, is connected to the canal by a 24-inch pipe line. The city is planning a civic celebration in connection with the first delivery of water sometime in August.

At Friant Dam on the San Joaquin River 20 miles northeast of Fresno, the first pouring of concrete was made the occasion for a celebration staged by the Fresno County Chamber of Commerce and the Central Valley Project Association.

A crowd of several hundred spectators, on observation point overlooking the dam site, were given a minute description of the initial pouring operation over a public address system. At Friant the placement of concrete is being done by a system quite different from cableways used at Shasta Dam. A trestle system, which will become a part of the dam structure is being used. Along this trestle will run huge hammerhead cranes with 300-foot arms and a whirley crane with a 125-foot boom.

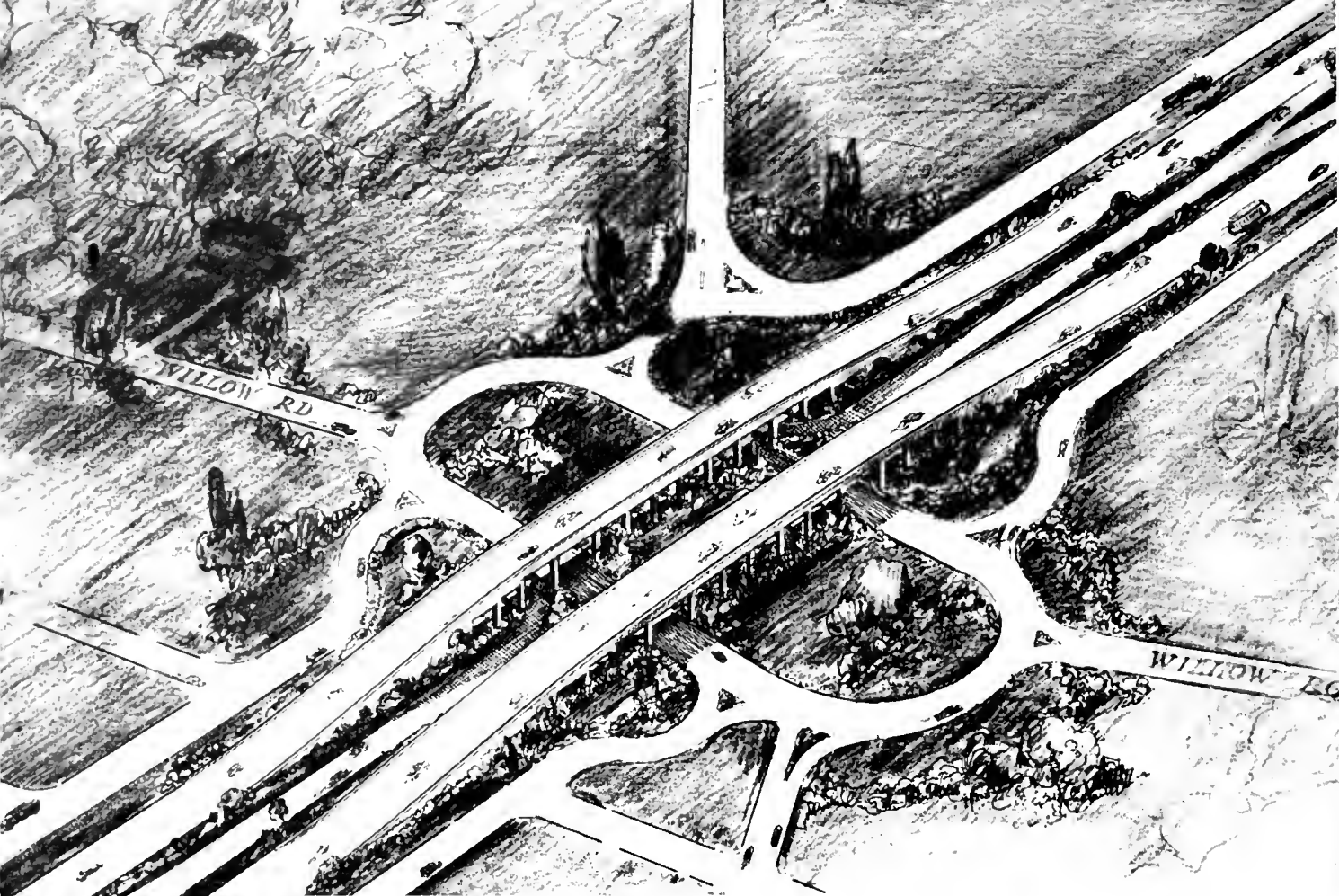
Concrete poured on the first day's operations, however, was placed from a temporary whirley crane on top of the south abutment. Automatically measured and weighed materials from four plants were churned together in the mixing plant near the trestle system and brought by an electric engine to a point beneath the temporary crane.

A heavy hook attachment at the end of long cables running from the end of the crane arm, dropped down to the electric train, picked up the first bucket of concrete and swung down to the bedrock in what engineers call block 17. Here waiting workmen tripped a trigger and the first four of the 1,000,000 cubic yards of concrete that will go into the dam sloshed out.

Block 17, in which the first concrete was poured is on the south, or Fresno County abutment of the dam. Pouring will continue in this abutment for approximately six weeks. Day and night work is scheduled.

Griffith Company and Bent Company, the construction firm, broke ground for Friant Dam on November

(Continued on page 20)



Engineers drawing of plan for carrying Bayshore through traffic on two separated overpasses at Willow Road intersection in Palo Alto with outside lanes for local traffic and safe access lanes to freeway.

Bayshore Freeway Plans Shown

By LAWRENCE BARRETT, Chairman Highway Commission

DUE TO the phenomenal growth of the San Francisco peninsula area, it is imperative that the State undertake as soon as possible the conversion, by stage construction, of the present Bayshore Highway between San Francisco and Palo Alto into a freeway, with six lanes divided by a median strip for high speed traffic and the construction of twenty-five overheads, underpasses, and major structures, which will eliminate all intersections on this route.

Director of Public Works Frank W. Clark presented a report covering every detail of the proposed project to the California Highway Commission

in session in San Mateo on July 26th.

The report was prepared by State Highway Engineer C. H. Purcell and Colonel Jno. H. Skeggs, District Engineer. Director Clark made the following statement relative to the State's plan of converting the Bayshore Highway into a freeway:

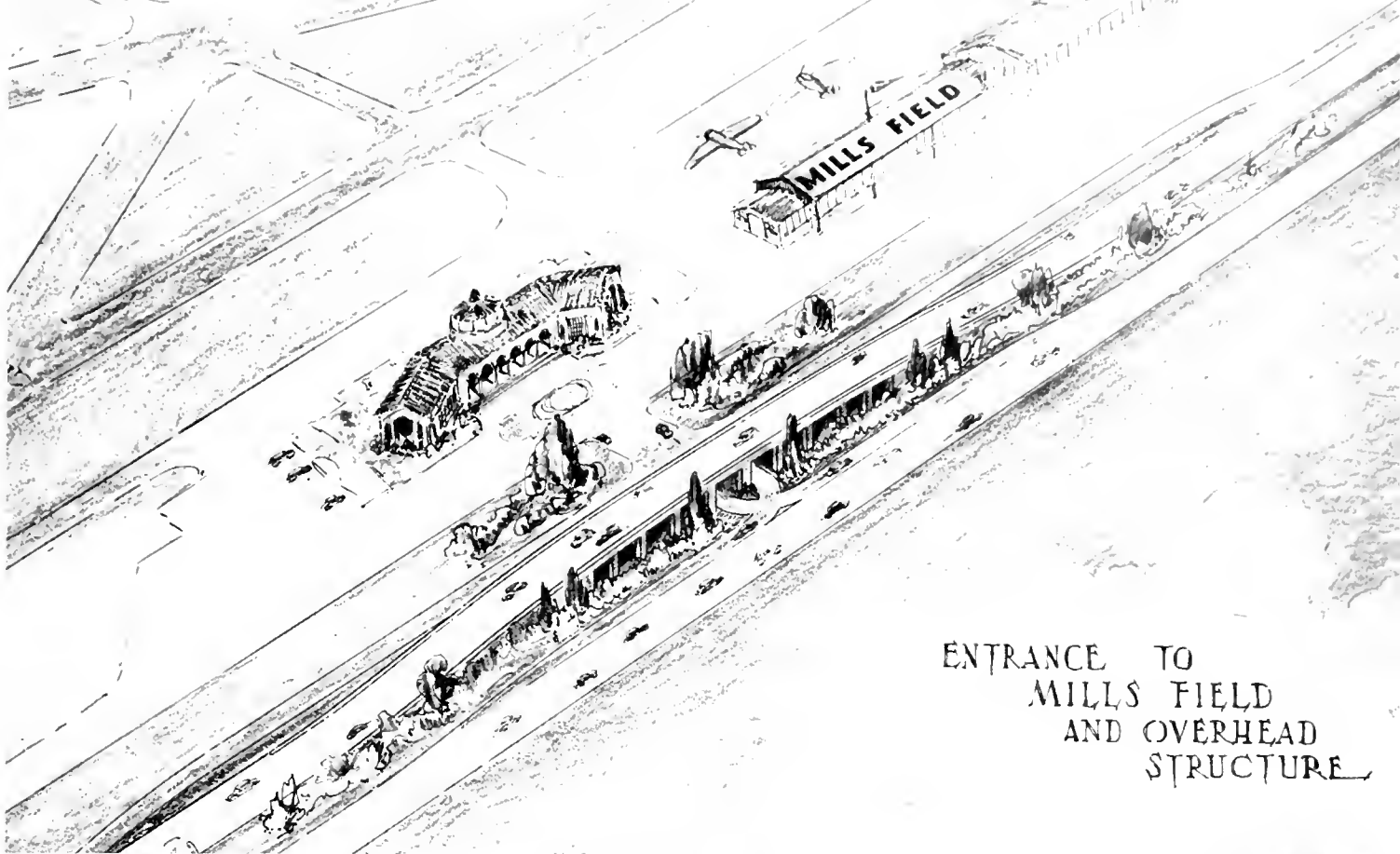
"In view of the increasing traffic congestion problems in our metropolitan areas, Governor Olson and the California Highway Commission are of the opinion that the logical solution of these problems in our largest cities is the construction of high-speed freeways such as the Arroyo Seco project now nearing completion between Los Angeles and Pasadena, and

this proposed freeway between San Francisco and Palo Alto.

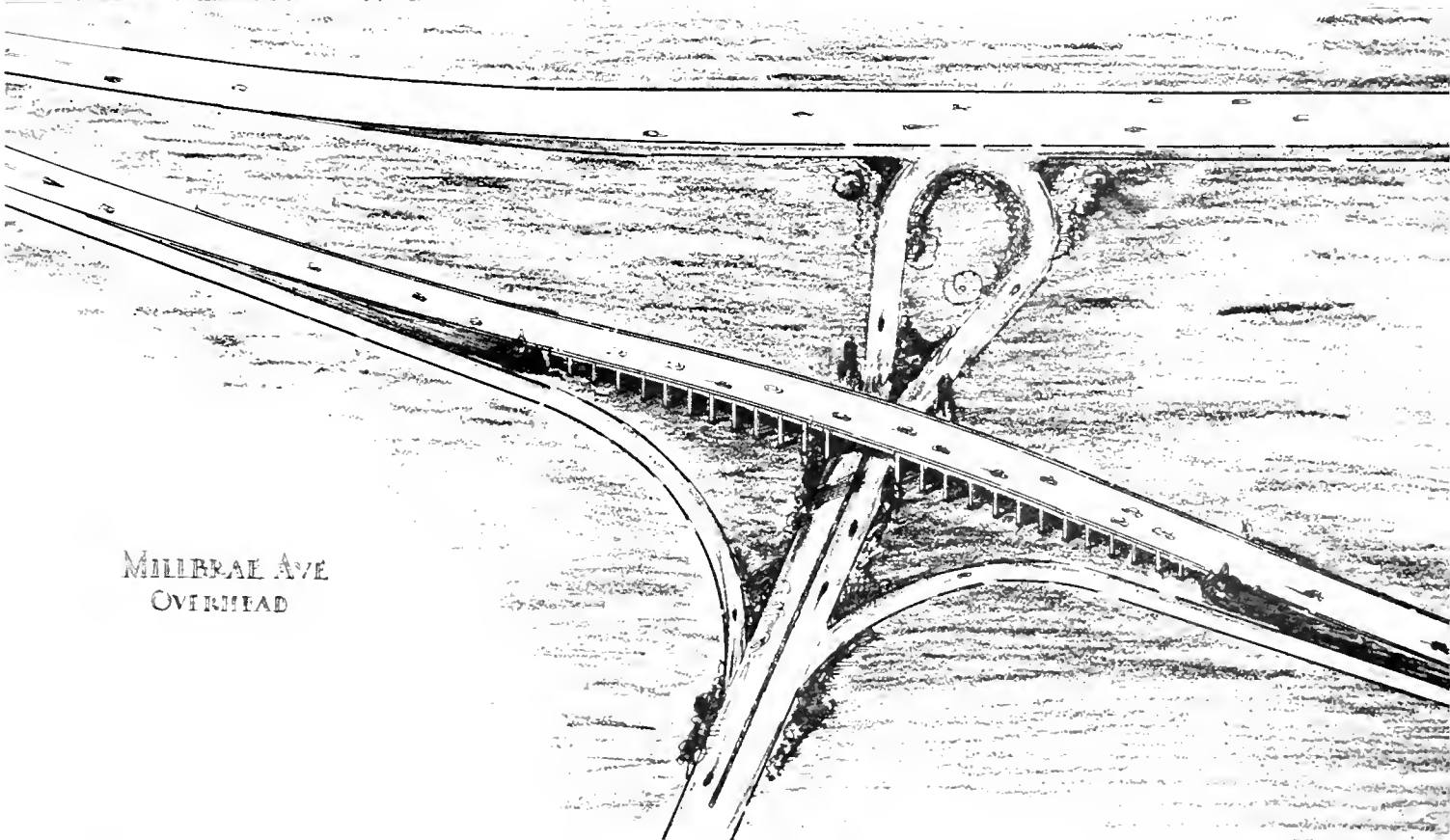
LONG RANGE PROGRAM

"Such undertakings involve the expenditure of large sums of highway funds, and necessarily must be built in sections under a long-range program. The present State administration is committed to a policy of assisting cities to solve their traffic congestion problems, and Governor Olson is greatly interested in having the Bayshore Freeway started as soon as moneys required may be provided for in the next biennial highway budget.

"The Arroyo Seco is the first free-



ENTRANCE TO
MILLS FIELD
AND OVERHEAD
STRUCTURE



MILLBRAE AVE
OVERHEAD

Upper drawing shows a proposed plan for entrance to Mills Field with one overpass structure in the separated freeway lanes. Below, Millbrae Avenue intersection showing existing highway separated by 40-foot division strip from new overhead with approach roads to both lanes.

way undertaken by the Highway Commission, and the Bayshore Freeway will be the first project of its kind in Northern California.

"In establishing the freeway principle on the Bayshore Highway the State will be able to conserve the full original investment in this route which is susceptible of expansion with a minimum of conflict with residential and property improvements."

State Highway Engineer Purcell's report pointed out that traffic from the San Francisco-Oakland Bay Bridge, from the Golden Gate Bridge, and the East Bay District, in addition to traffic from San Francisco, now pours onto the Bayshore Highway, which is inadequate to handle the ever-increasing traffic. In less than ten years Mr. Purcell believes that both the El Camino Real and the Bayshore Highway will be carrying capacity traffic.

TENTATIVE PLANS SUBMITTED

In his report to the Commission Director Clark submitted tentative plans and drawings for the contemplated freeway, extending from the vicinity of Third Street in San Francisco to the Embarcadero Road-Oregon Avenue intersection in East Palo Alto, a distance of some 27 miles. The first unit of the project will be from the South San Francisco Underpass to and including Broadway in Burlingame, at an approximate cost of \$2,300,000.

The Bayshore Highway, from the San Francisco City and County line through San Mateo County, was added to the State Highway System by legislative enactment in 1923 and construction of the first unit of the existing highway between South San Francisco and Burlingame, a distance of 5½ miles, was started in September, 1924, and since that date one unit has been completed during each biennial period, until up to the present time the last section is ready for use by the motoring public.

"Over this sixteen-year period of construction," Director Clark said, "the daily traffic on this route has increased from nothing to a present volume of some 30,000 motor vehicles of all types. As a consequence, that portion of this highway between San Francisco and Palo Alto should be progressively expanded and modernized, not only to adequately handle present-day traffic, but to care for the traffic increase which will soon overtax the present improvement.

"The Bayshore Highway has de-



Director Clark hands proposed Bayshore Freeway report to Chairman Barrett.

veloped into one of the most important main trunk highways of our State for commercial vehicles and through traffic destined for the southerly sections of the State. Its proximity to the San Francisco Airport, at Mills Field, and Moffet Field at Sunnyvale, emphasizes its importance for national defense. It has assumed greatest importance, however, in serving to accommodate an ever-increasing volume of fast, or express commuter-type of traffic, between the focal business area of San Francisco and the residential urban areas on the peninsula."

Director Clark submitted to the Commission a report from State Highway Engineer Purcell, which revealed, that compared with the State-wide average of 1.4 accidents per million vehicle miles, the rate of the Bayshore Highway was 2.9, or slightly more than twice the general average. The report said that conversion of the Bayshore Highway into a freeway should eliminate or greatly reduce head-on, intersection, pedestrian, and "U"-turn accidents.

The Bayshore Highway throughout San Mateo County, compared with other four-lane highways in the State, ranks as one of the highest in accident rate per million vehicle miles traveled. During 1939 there were

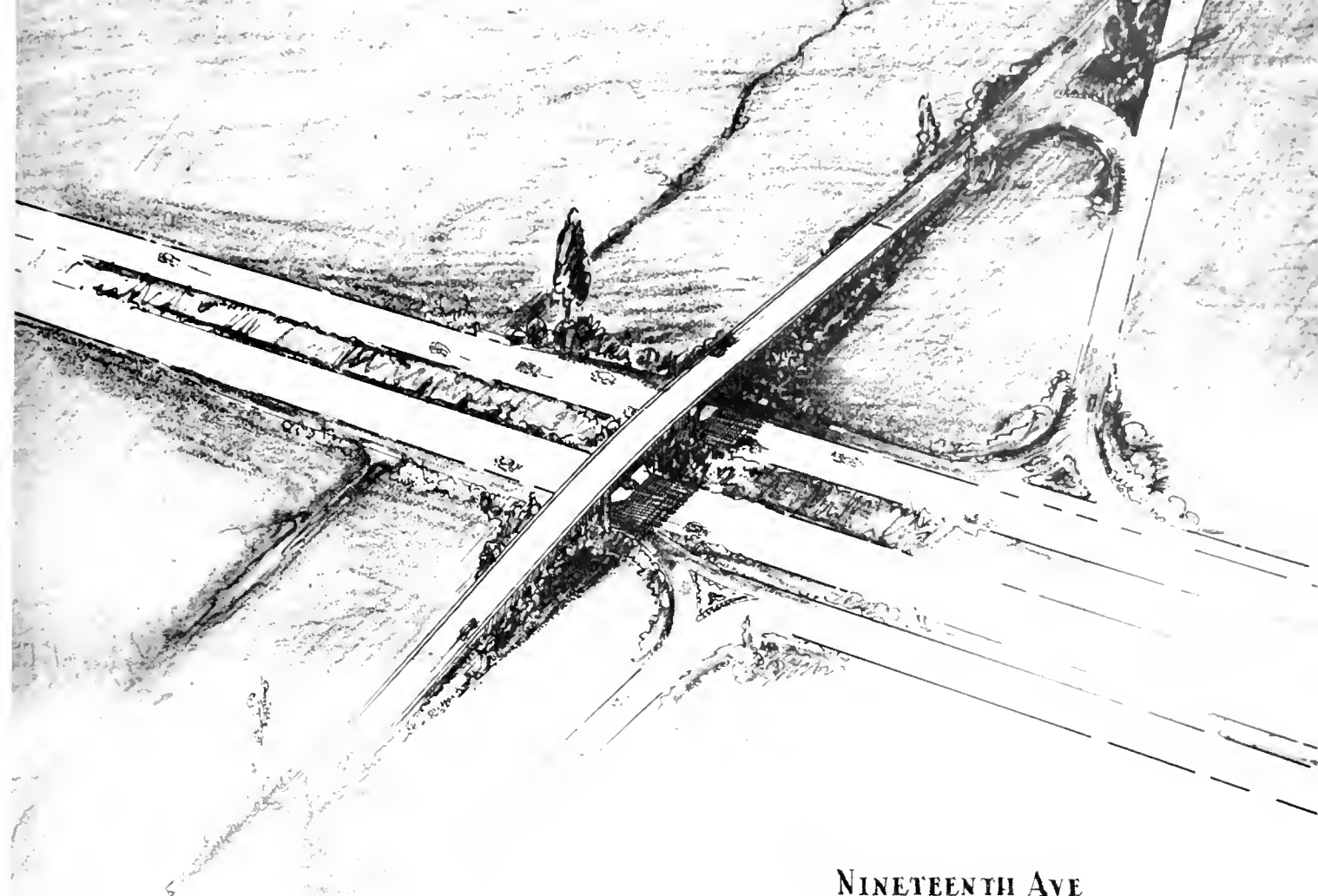
276 accidents on this section, involving 19 fatalities and 235 injuries. Using a conservative figure of \$5,000 per fatality, \$300 per injury, and \$50 per accident for property damage, it is apparent that there was an economic loss of \$179,300 during 1939 due to accidents on this stretch of highway.

ONLY FEASIBLE FREEWAY

The Peninsula Area in general, and San Mateo County in particular, must be considered as a part of greater San Francisco. Due to the topography, the number of main arterials serving this area is limited and the Bayshore Highway offers the only route lending its expansion into a freeway.

The freeway portion, or interlanes, of the proposed new highway have been designed 12-11-12 feet in width, a total of 35 feet on either side of the central division strip—thus providing a six-lane freeway. Acceleration and deceleration lanes, in addition to the 35-foot width, of the 11-foot width, and sufficient length to properly decelerate or accelerate to design speeds, have been provided.

The magnitude of this project in its entirety is such that it will require all funds which can be made available by the State, various incorporated cities and towns, and the



NINETEENTH AVE SAN MATEO

Proposed overpass at Nineteenth Avenue, San Mateo, crosses widely separated freeway lanes with curved approaches providing safe access to highway.

counties, in addition to such federal aid as may be obtained.

"In addition to financing the initial construction on portions in San Mateo County" said Mr. Clark, "some assistance from all public bodies interested may be necessary to produce the Bayshore Freeway as an accomplished project. It is hoped this result can be obtained by 1950 or sooner."

101 PER CENT INCREASE

In his report Highway Engineer Purcell said that the combined traffic on the Bayshore Highway and El Camino Real, serving the potential population area of the Peninsula in the period 1928 to 1939, has increased 44 per cent on Sundays and 101 per cent on Mondays.

The proposed freeway, 27 miles in length, starts with a grade separation at Third Street in San Francisco, proceeding with a new and direct freeway location to Sierra Point,

thence expanding on the east side through San Francisco, thence by revisions on both sides to south of Broadway, Burlingame, from which point on to the Embarcadero Intersection south of Palo Alto, widening on the east side of the existing alignment throughout, is recommended by Mr. Purcell.

Ultimately it is planned to plant trees and shrubs along the entire length of the dividing strip.

Moving pictures showing the broadly divided freeways or parkways of the metropolitan area of New York and on Long Island were exhibited to the Commission, showing the great advances in development of such arterials in the East.

The Commission heard delegations from the City and County of San Francisco; San Mateo; California State Automobile Association; San Francisco Chamber of Commerce and San Francisco Supervisors, all en-

dorsing the proposed freeway expansion of the Bayshore Highway.

In behalf of the Highway Commission I can give assurance that under the present administration there will be set up in the coming budget, sufficient funds to start this program on the Bayshore Highway that will result in a highway of which we will all be proud. In the construction of this improvement consideration will be given to a freeway.

Realizing the importance of this highway we will set up a sum for the construction of a portion of the project looking forward to the full completion of it in the future.

While the cost of the improvement in its entirety will be tremendous, the saving of life and property and the relief of dangerous traffic conditions will fully justify any expenditure required to make the Bayshore Highway a modern, safe route. As a

(Continued on page 23)

Engineering Details And Route Of Proposed Bayshore Freeway

By C. H. PURCELL, State Highway Engineer

IN sixteen years since the opening of the first section of the Bayshore Highway in 1924, traffic has increased from nothing to 30,000 vehicles per day, while traffic on El Camino Real, the original and only other peninsula highway, has remained nearly constant.

The Bayshore is an important trunk for through state and commercial traffic, and a key-route from the standpoint of national defense, but is most important in serving fast commuter-type traffic from the suburban peninsula area, which is a part of greater San Francisco. This commuter and week-day local traffic is most closely correlated to vehicle registrations of San Mateo County alone. Sunday traffic is affected more by the combined vehicle registrations of San Francisco, San Mateo and Santa Clara counties.

The combined traffic on State Highway Route 2 (El Camino Real) and 68 (Bayshore highway) serving the potential populated area of the peninsula in the period 1928-1939 has increased 44 per cent on Sundays and 100 per cent on Mondays. Forecasts of 15-hour daily traffic on the Bayshore Highway at the South San Francisco under-pass for 1950 is 43,000 for Sunday and 34,000 for Monday, with present facilities having a maximum capacity of 32,000 vehicles. For 1965 the traffic forecast is 50,000 and 41,000 respectively for Sundays and Mondays.

With expanded Bayshore facilities, with induced traffic, 16-hour daily Sunday volume is forecast at 46,000 for 1950 and 60,000 for 1965. Monday traffic forecast is 38,000 by 1950 and 55,000 by 1965. Mass transportation by bus, on the proposed freeway prior to 1965 should level off peak hour travel increasing generally accepted highway traffic 20 to 25 per cent week-day travel. Sunday travel during evening peak-hour by 1965 should flow uniformly on the freeway, but at modified speeds.

Capitalized reducible accidents on the Bayshore Highway in San Mateo County would justify an investment of one and one-half million dollars from that standpoint alone. The Bayshore is the logical and only route which can be expanded to freeway design due to topography and property improvements. All of the present capital investment can be conserved for public use.

A start should be made now toward expanding the Bayshore Highway to a six-lane freeway design. The first unit should be between the South San Francisco under-pass and Peninsula Avenue, near the cities of Burlingame and San Mateo.

The proposed route, 27 miles in length, starts with a grade separation at 3d Street in San Francisco, proceeding with a new and freeway location at Sierra Point, thence expanding on the east side through South San Francisco, thence by revisions on both sides to south of Broadway, Burlingame, from which point on to the Embarcadero intersection south of Palo Alto, widening on the east side of the existing alignment throughout is recommended.

Full cooperation of all incorporated cities, the county, the State and Federal government, will be required to start and prosecute this major San Francisco metropolitan highway project to successful conclusion in time to realize and insure the full economic benefits which it can bestow upon the community and the State.

The recommendations of the Division of Highways are as follows:

1. The reconstruction of the Bayshore to consist of a six-lane highway of the freeway type.

2. The highway to be declared a freeway from Third Street in San Francisco to Oregon-Embarcadero Road in Santa Clara County.

3. The 6.6 mile section from immediately south of South San Francisco Underpass, to and including Peninsula Avenue, Burlingame, to be started and proceed by stages as the first unit. Surveys and design to proceed so right-of-way negotiations may start and this project may be advertised for construction as soon as funds are made available.

4. An allotment of funds for acquisition of right-of-way on the preceding section, and acquiring key parcels for protection where required between San Francisco and San Mateo.

5. Surveys and design to be started in San Francisco, toward acquisition of rights-of-way, by agreement, with $\frac{1}{4}$ ¢ Gas Tax funds for State Highways in San Francisco.

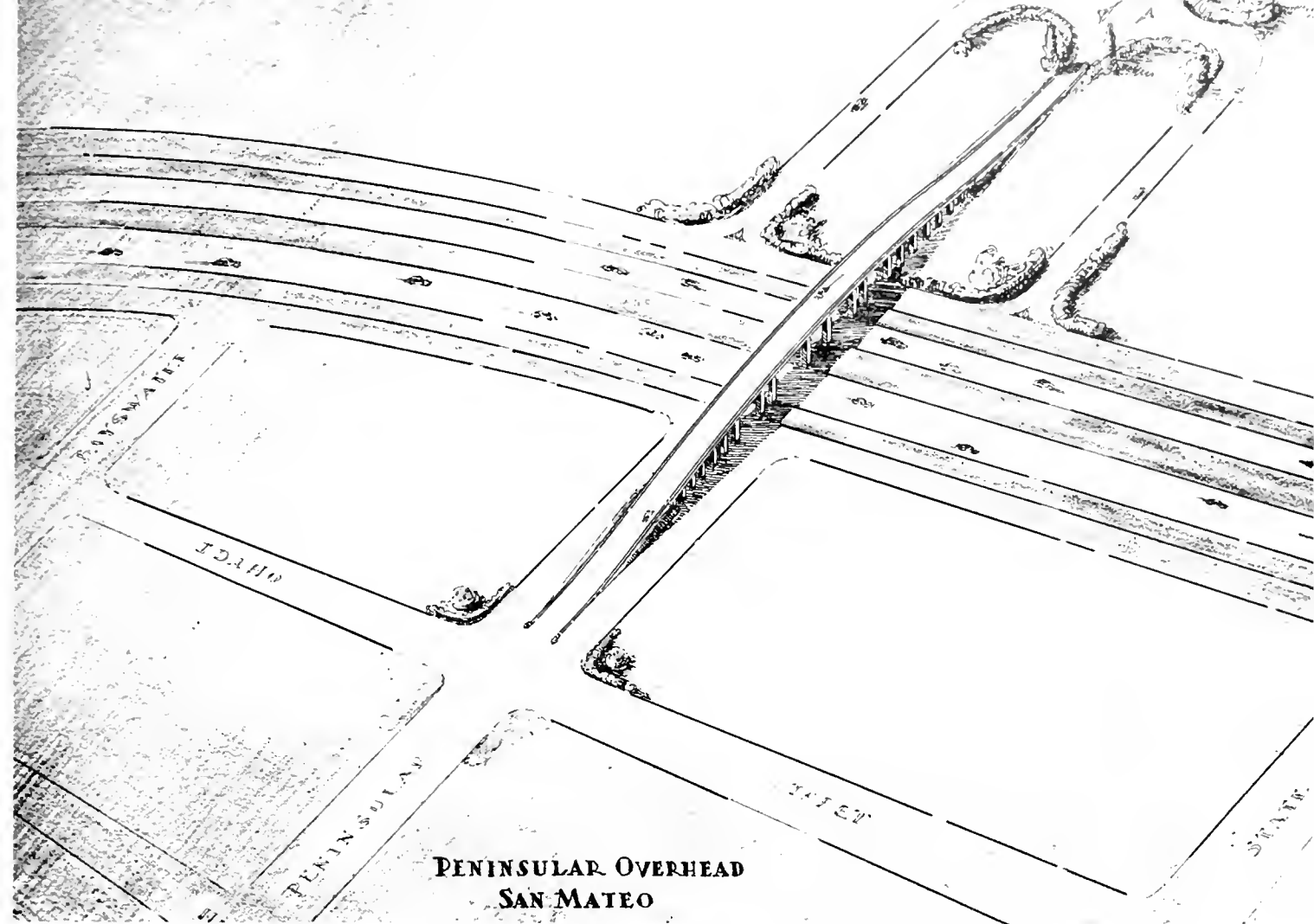
6. Request cooperation of cities and county in protection of existing set-backs, establishment of additional set-backs where required, and financial assistance in acquiring key parcels if necessary to avoid building and other improvements, where required on the entire project.

The route of the proposed freeway is as follows:

a. Third Street in San Francisco to Sierra Point.

About one-third of both the week-end and week-day travel on the Bayshore Highway south of Third Street in San Francisco enters or leaves at Third Street. The ratio of interfering traffic to through traffic movement is 30 per cent, the highest of any individual intersection on the entire project. Traffic signals, combined with street car traffic crossing the Bayshore at an acute angle, make this a point of serious delay to the main Bayshore travel.

A relocation of this route, leaving the existing road for the use of local travel, one direct relocation south-erly from Third Street and across the shallow bay waters to Sierra Point, appears to be the most fea-



PENINSULAR OVERHEAD SAN MATEO

Proposed intersection plan for Peninsula Avenue, San Mateo. Separated freeway lanes, overpass structure, with service and access lanes for local traffic.

ible and economical solution. The present Bayshore grade line in the vicinity of Third Street is rolling, with a peak at Third Street, making it feasible to construct an underpass as a part of this project, which would actually start at Salinas Street for proper connection, and to make provision for complete traffic separation and access facilities to Third Street.

6-MILE SECTION

This improved alignment would have a maximum 4 per cent grade, and would represent a saving in distance of .37 mile, equivalent to more than \$150,000 saving in vehicle operating costs per year, which, capitalized at 7 per cent, would justify a capital investment of some \$2,200,000 from this standpoint alone.

Access to the freeway is planned for Blenken Street, and at the southerly end of the section south of Sierra Point. Two bridges have been planned for the Bay section, and another

other over the main line of the Southern Pacific at Sierra Point.

Length of this section is 3.8 miles.

b. Sierra Point through South San Francisco.

The present highway of 40-foot paved width in a 125-ft. width of right-of-way, has been widened to curbs 100 feet wide through the city portion. This widened portion has, however, been surfaced only with a light armor coat, in contrast to the 40 feet of main heavy concrete pavement. Traffic is becoming so heavy that during peak hours it is commonly observed traveling one, and sometimes two lanes on each side of the concrete pavement, for this section.

Grand Avenue, with traffic signals, and a 21 per cent conflict of interfering traffic to through traffic movement, most of which is cross-traffic, is another point of appreciable delay during peak hours of

traffic, in particular, but to all traffic, in general.

The present underpass under the Southern Pacific Railroad has a 1,000-ft. radius curve, in contrast to the approximate 3,000-ft. minimum radius planned for the freeway design. It has a superelevation of only one-tenth of present standard for high-speed traffic, and an existing vertical clearance of 1.1 feet under present desirable minimum. It therefore presents a barrier for consideration in widening the existing pavement on the present alignment, in view of the grade separation which must be provided for Grand Avenue. Grand Avenue serves the large industrial point jutting eastward from South San Francisco, and is a through street which can not be ignored.

Our studies indicate that the greatest economic return and value can be obtained by widening the present highway on the easterly side, over-



One-way freeway lanes are widely separated in this sketch for the Broadway intersection at Burlingame. Cars entering or leaving the freeway would use the big loop curves providing safe connections with either lane.

passing Grand Avenue and the Southern Pacific mainline tracks with one structure east of the present underpass, reserving the latter for local entrance and exit to and from the town of South San Francisco.

As with the section preceding, a narrow, or 6-ft. minimum width of division strip between the inner freeway lanes, has been planned for this section. The existing highway pavement would continue as the outer lane serving local traffic for this section.

Access to and from the freeway is planned at the northerly city limits, at Grand Avenue and vicinity, and south of the present South City underpass, with appropriate access and separation structures.

This section is 1.8 miles in length.

c. South San Francisco Underpass to Peninsula Avenue in Burlingame.

Due to the character of the terrain this section traverses, the location of Mills Field and immediate plans for its development and others in Burlingame and San Mateo, to conserve the value of the investment in the present highway, there appears to be only one proper and logical solution for the reconstruc-

tion of this section of highway.

After due consideration of all factors involved, it is recommended this section be developed by stages to an ultimate "Freeway" design, and become the initial unit of construction.

The freeway is planned to consist of the use of the present roadway for one-way traffic, a new three-lane roadway to be constructed and separated from the present pavement by means of a 40-ft. minimum width of division strip. The division strip, with the initial construction of the new roadway, will provide immediate relief at the intersections made with San Bruno Avenue, entrance to Mills Field, Millbrae Road, Broadway, Burlingame, and Peninsula Avenue, where ultimate grade separations are planned.

This section of highway has a very high accident rate, and of these accidents almost 60 per cent are of the type which will be eliminated by the construction of dual roadways with protection at intersections. The first stage, including the channelization of these intersections, will facilitate flow of traffic and provide safety features which are lacking on

the highway at the present time, although maximum freeway principle can not be realized either from traffic flow or safety until the grade separations are built.

The alignment of the new roadway is planned to parallel the westerly side of the present pavement to near Millbrae Road, thence diverging and continuing on direct course to the present connections with Broadway, Burlingame. Due to imminent development and increased future values of property on the westerly side of the Bayshore south of Broadway, Burlingame, and to provide for a very attractive and efficient entrance to Broadway, a transition is made at this point and the new roadway will be provided for by widening on the easterly side from this point to Embarcadero Avenue in Palo Alto.

Due to the existing development between Broadway, Burlingame, and Peninsula Avenue, outer lanes are planned on the westerly side of the present roadway to provide for local traffic movements between these two points.

The improvement of this section, of 6.6 miles in length, will promote

and accelerate the development of the whole Peninsula area to a greater immediate extent than could be expected from the improvement of any other section as the first unit.

Cost of right of way depends upon negotiations for large holdings by the City and County of San Francisco.

An allotment of \$600,000 is recommended to acquire rights of way to this section and to acquire key parcels for protection at other locations where required between San Francisco and San Mateo.

d. Peninsula Avenue, Burlingame, to Main Street, Redwood City.

The present highway of this section traverses low delta land and salt marsh to Redwood City. The existing alignment is satisfactory, and ex-

Ultimate grade separation structures are proposed at Third Street—San Mateo, Nineteenth Avenue—San Mateo, Ralston Avenue—Belmont, Holly Avenue—San Carlos, and Jefferson Street—Redwood City.

Present traffic conflict using these connecting roads and related trends indicated that the first separation structures should be provided for at Third St. in San Mateo and at the entrance to Redwood City, with other separations to follow as the development of the various areas requires.

Pending increased traffic volumes on these intersecting roads, provision can be readily made to channelize the dividing strip at these points and in so doing, reduce the potential accident hazard to a minimum.

The construction of outer lanes will

be necessary from Peninsula Avenue to approximately Tenth Street in San Mateo, to serve local traffic in the adjacent residential and business areas.

This section is 8.7 miles in length.

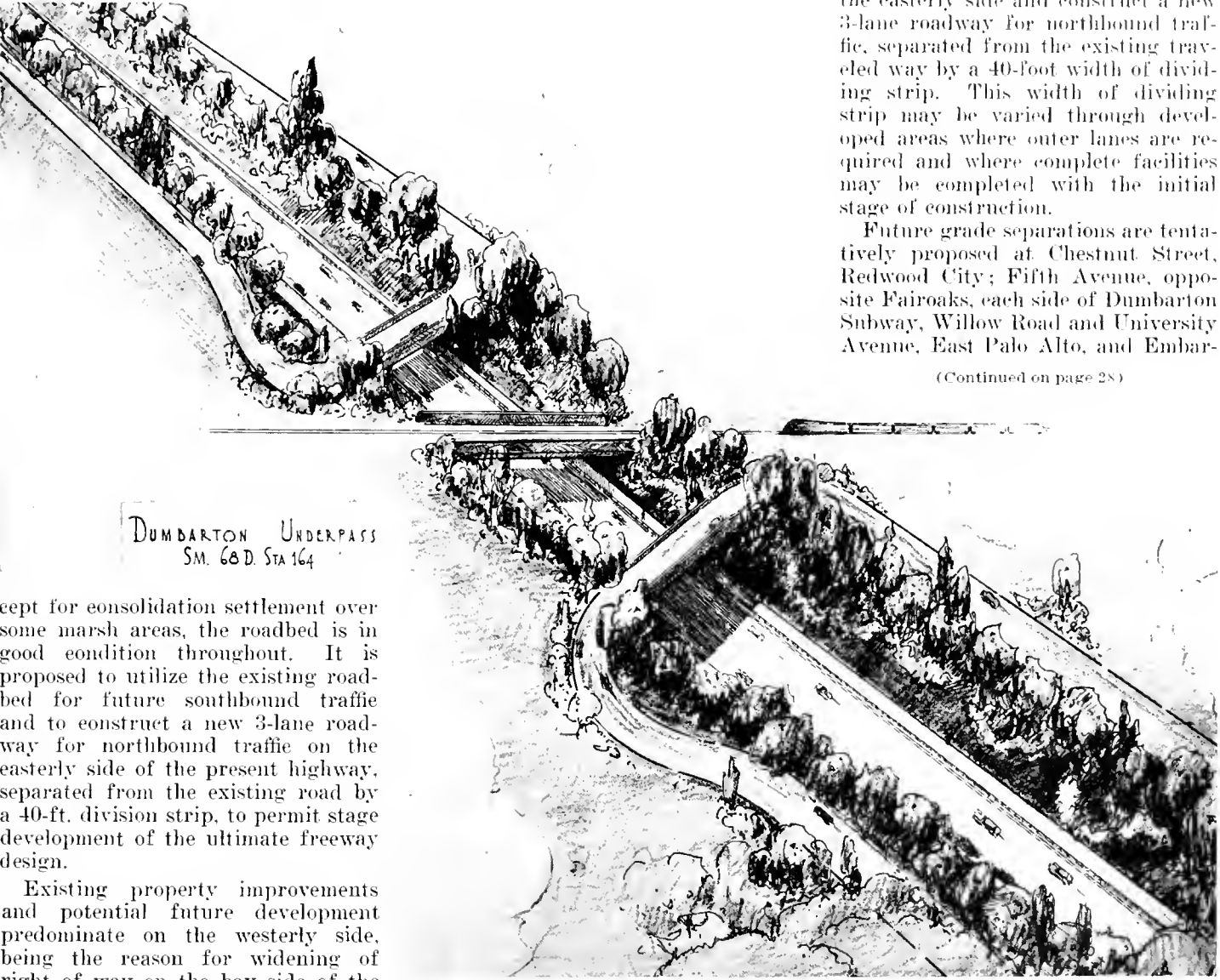
e. Main Street, Redwood City, to Embarcadero Road south of Palo Alto.

This section of existing highway, 6.2 miles in length, traverses agricultural lands and existing or potential urban developments. The alignment, grade and roadway pavement is satisfactory and is readily adaptable to the same type of improvement as proposed for the preceding section.

In general, it is proposed to use the existing roadway for southbound traffic and to widen the right of way on the easterly side and construct a new 3-lane roadway for northbound traffic, separated from the existing traveled way by a 40-foot width of dividing strip. This width of dividing strip may be varied through developed areas where outer lanes are required and where complete facilities may be completed with the initial stage of construction.

Future grade separations are tentatively proposed at Chestnut Street, Redwood City; Fifth Avenue, opposite Fair Oaks, each side of Dumbarton Subway, Willow Road and University Avenue, East Palo Alto, and Embar-

(Continued on page 28)



cept for consolidation settlement over some marsh areas, the roadbed is in good condition throughout. It is proposed to utilize the existing roadbed for future southbound traffic and to construct a new 3-lane roadway for northbound traffic on the easterly side of the present highway, separated from the existing road by a 40-ft. division strip, to permit stage development of the ultimate freeway design.

Existing property improvements and potential future development predominate on the westerly side, being the reason for widening of right of way on the bay side of the existing highway.

Grade separations tentatively proposed at Dumbarton Subway.



Photo Courtesy Los Angeles Herald-Express

State, county and city officials inspecting 3.7 miles completed section of Arroyo Seco Parkway.
Third from right is Public Works Director Clark.

Arroyo Seco Parkway Unit Open

By S. V. CORTELYOU, District Engineer

CONSTRUCTION barricades were removed at six o'clock Saturday morning, July 20th, and a 3.7 mile section of the new Arroyo Seco Parkway, between Orange Grove Avenue in South Pasadena and Avenue 40 in the City of Los Angeles, was opened to traffic.

This section of modern freeway has not been entirely finished, inasmuch as the planting of shrubs in the central dividing strip and on each side of the freeway has not been completed. However, it was desired to give the public the benefit at the earliest possible time of this new safety highway, especially as it will remove the through traffic from the long business area in Highland Park and permit it to develop

naturally without the handicap of a large volume of nonpurchasing through traffic which interfered with their local customers.

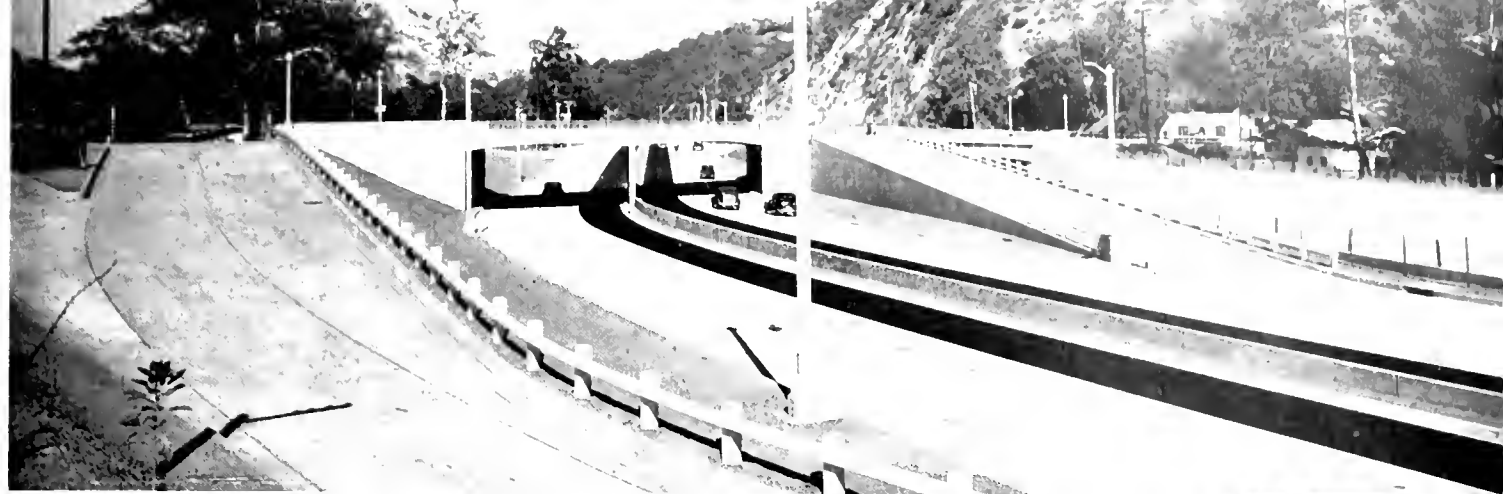
This 3.7 mile section and the 0.8 mile portion between Glenarm Street in Pasadena and Fair Oaks Avenue, opened to traffic last year, make a distance of 4.5 miles of the Arroyo Seco Parkway now giving service to the motorists. The only two "gaps" remaining to be completed, are from Avenue 40 to Avenue 22 in Los Angeles (one mile) and from Meridian Street to Fair Oaks Avenue in South Pasadena, a distance of 0.4 mile.

Work on the former section is progressing rapidly under three separate contracts, and will be completed about November 1st. The

portion between Meridian Avenue and Fair Oaks Avenue in South Pasadena will be let to contract within a short time and it is anticipated that the entire 6-mile project from Glenarm Street in Pasadena to Avenue 22 in Los Angeles will be completed early next spring.

Much favorable comment is heard from those using the new freeway in that it is so much safer, more convenient and requires so much less time than the old route via Figueroa Street.

The reasons for these improved traffic conditions are built into the highway itself—three wide traffic lanes on each side of a raised central dividing strip with high standards of alignment and no streets or railroads crossing at grade.



Arroyo Seco Parkway sections between Pasadena and Los Angeles recently opened showing 35-foot divided lanes, bridges and service roads.

Traffic after entering the Parkway can proceed at the maximum State speed limit for an open road and does not need to stop until after leaving the Parkway. All curves are suitably "banked" or superelevated.

vated for safety at legal speeds.

At appropriate and convenient locations, inlets and outlets are provided by means of one-way roads or ramps with widened pavement at these points for blending with or withdrawing from the faster moving traffic on the main freeway.

Turning movements across traffic are entirely eliminated by a raised curb central dividing strip without openings or cross overs. One can travel this highway with the assurance that a car will not suddenly emerge from a side street or cross over the center line and approach "head on." Thus traffic on the three lanes of pavement in each direction moves with a freedom from interference not experienced on any but the most modern of highways.

ROAD CAPACITY INCREASED

As a result of this safety and freedom of movement and elimination of all stops, there is a material increase in the carrying capacity of the highway. On the average highway in a densely populated area similar to this one, intersection delays and interference from turning movements tend to "pile up" traffic and release it in waves rather than in a steady flow, thereby reducing to a large degree the traffic carrying capacity of the highway. These unfavorable conditions have been entirely eliminated in the Arroyo Seco Parkway in accordance with the most modern trend in highway design.

On the portion of the highway just opened to traffic, intersecting streets cross the Parkway on overhead bridges at Avenue 43, Avenue 52, Hermon Avenue, Avenue 60, Marmion Way, Pasadena Avenue, Arroyo Drive, Grand Avenue and Orange Grove Avenue.

Traffic in either direction can enter at Avenue 43, Avenue 52, Avenue 57, Hermon Avenue, Avenue 60 and Marmion Way. Traffic traveling toward Los Angeles can also enter at Salonia Avenue.

Traffic in either direction can leave the Parkway at Avenue 43, Avenue 52, Avenue 57, Hermon Avenue, Avenue 60 and Marmion Way, and traffic traveling toward Pasadena can also leave at Hough Street.

Planning and construction of the Arroyo Seco Parkway has required the closest cooperation among the various governmental and corporate agencies involved. The project lies



Director Clark congratulating Resident Engineer Hatfield.

within three cities, namely Los Angeles, South Pasadena and Pasadena, and the engineering departments and other officials of these three cities have worked in close harmony with the State Division of Highways.

City Engineer Harvey W. Hincks of Pasadena and his assistants made early plans for the Parkway in Pasadena and South Pasadena. Special mention should be made of the very effective efforts of City Engineer Lloyd Aldrich of Los Angeles in securing for the people of Los Angeles City, after numerous trips to Washington, D. C., the allotment of large amounts of Federal Relief Funds for important engineering projects in Los Angeles City.

One of the most important of these was their financing of the paved channel for the Arroyo Seco flood waters from South Pasadena to the Los Angeles River. Without this control of the flood waters, it would not have been possible to build and maintain the Arroyo Seco Parkway in its present location.

Also, much credit is due Mr. Aldrich and his Deputies, Merrill Butler, L. E. Arnold, C. J. Shults, L. W. Armstrong and R. W. Stewart, for preparation of plans for the Parkway with its large number of bridge structures, in cooperation with the State engineers.

RESULT OF COOPERATION

The Park Commission of Los Angeles City has cooperated, not only in furnishing to the State the right of way for the Parkway from the north city limits to Avenue 35, but in assisting in the general landscaping program.

The U. S. Public Roads Administration, the Works Progress Administration and the Public Works Administration have had important parts to play in the construction of the Parkway and of storm drains and lining the Arroyo Seco Channel to properly care for flood waters and protect the Parkway from damage.

The Santa Fe and Union Pacific Railroads were interested in that they each crossed the Parkway in two places. These railroads cooperated with the State in arranging for the necessary changes in their facilities on their private rights of way to fit in with the Parkway, in such a manner as to involve a minimum cost to the State.

DOUBLE RAILROAD BRIDGE

On the Parkway east of Orange Grove Avenue in South Pasadena, there are now under construction the Meridian Street Bridge, Fremont Avenue Bridge, Fair Oaks Ave-



Arroyo Seco Parkway at Avenue 52 is crossed by 2 bridges, one with ramps and other over paved stream channel.

nue Bridge, and a double track railroad bridge at Freemont Avenue to carry the Santa Fe and Union Pacific Railroads over the depressed Parkway. At the proper stage of construction of these bridges, the final highway contract will be let for roadway grading and paving between Meridian Street and Fair Oaks Avenue, which will complete the entire Arroyo Seco Parkway from Glenarm Street in South Pasadena to Avenue 22 at the Los Angeles River Viaduct in Los Angeles.

The entire project is being fenced with a high ornamental fence to prevent pedestrians or animals from having access to the Parkway. Since children and elderly persons will use this long stretch of City Park, it was absolutely necessary to make it impossible for them to stray onto the Parkway with its large volume of fast moving traffic. The fences will be covered with a leafy screen of appropriate shrubbery.

EXTENSIVE PLANTING PROGRAM

In cooperation with the City Park Departments of Los Angeles, Pasadena and South Pasadena, the full length of the Parkway is being landscaped under State supervision.

The work includes planting the slopes and the strip between the central dividing curbs as well. This new highway will be truly a "Parkway," beautiful as well as serving traffic to the fullest extent.

The new section over which thousands of Southern California people have driven during the last few days gives an idea of the motoring comfort which will be enjoyed in the future by the vastly greater number of people who daily or frequently travel between Los Angeles and Pasadena, and the territory contiguous to the Arroyo Seco Route.

All construction work on the Parkway with its many bridge structures has been under the supervision of the State Division of Highways. The State also furnished the sponsor's fund for the W.P.A. channel work from Avenue 52 to the Los Angeles River.

SOURCES OF FUNDS

The total cost of the Arroyo Seco Parkway from Avenue 22 in Los Angeles to Glenarm Street in Pasadena will be approximately \$5,000,000 including the portion of the storm drain and channel work essential to

the Parkway. This was financed by the various governmental units as follows:

State 1½¢ Gas Tax Fund.....	\$2,614,547.72
1¢ State Highway Gas Tax for Pasadena.....	335,981.98
1¢ State Highway Gas Tax for South Pasadena.....	64,778.36
1¢ Streets of Major Importance Gas Tax for South Pasadena.....	12,271.04
1¢ State Highway Gas Tax for Los Angeles.....	40,000.00
South Pasadena City Funds.....	644.16
Los Angeles City Funds.....	113,584.14
P.W.A. Funds.....	472,315.63
W.P.A. Funds.....	1,394,364.73
Total	\$5,048,487.46

In addition to the above, the cost of the Arroyo Seco Channel work as a Federal Relief Labor project under City Engineer Aldrich, including Federal costs, was about \$7,000,000, making a grand total for the combined projects of \$12,000,000.

One engineer to another: Grab the end of that wire.
 "All right."
 "Feel anything?"
 "No."
 "Well, then, don't touch the one next to it—it's got over 5000 volts."

Meyers Grade Relocation Opened Eliminating Dangerous Switchbacks

THE MORE tortuous curves and steep grades of the Echo Summit route through the Sierra Nevada region of El Dorado County will be only memories for the motorists using this route with the completion of surfacing work on a section of the Meyers grade relocation of the Placerville-Lake Tahoe highway and the opening of the new road to traffic which occurred on July 17.

The new routing greatly improves the safety of the road by eliminating switchbacks with sharp curvatures and steep grades of 11 per cent and descends on a grade not exceeding 5.6 per cent to the present road below the switchbacks.

The grading of this portion of US 50, extending from a point two miles east of Phillips to three miles west of Meyers, was completed in June, 1939, by Louis Biasotti and Son and John Rocca, under the supervision of the Public Roads Administration at an approximate cost of \$300,000. The new section of road was constructed on entirely new alignment, as a National Forest Highway project financed from Forest Highway funds. The location was established by surveys of the State Division of High-

ways with final plans completed by the Public Works Administration.

In the August, 1938, issue of "California Highways and Public Works" an article was published describing the construction operations then under way on this project. This article also brought out the fact that the irregular rock bluffs near the summit necessitated heavy blasting and the use of solid benches or retaining walls for the support of the roadway in various locations. At one point it was necessary to construct a reinforced concrete bridge 113 feet long because of lack of any support for an embankment.

Although selected material was placed on a portion of the road under the grading contract, no provision was made for surfacing and the project was therefore barricaded until surfacing, which was to be built by the State, could be constructed.

In the fall of 1939 a contract was awarded to Lee J. Immel, calling for the placing of imported surfacing material where the existing material was not suitable and for the application of a road-mix surface treatment 0.25 of a foot thick. The imported surfacing material consists of disinte-

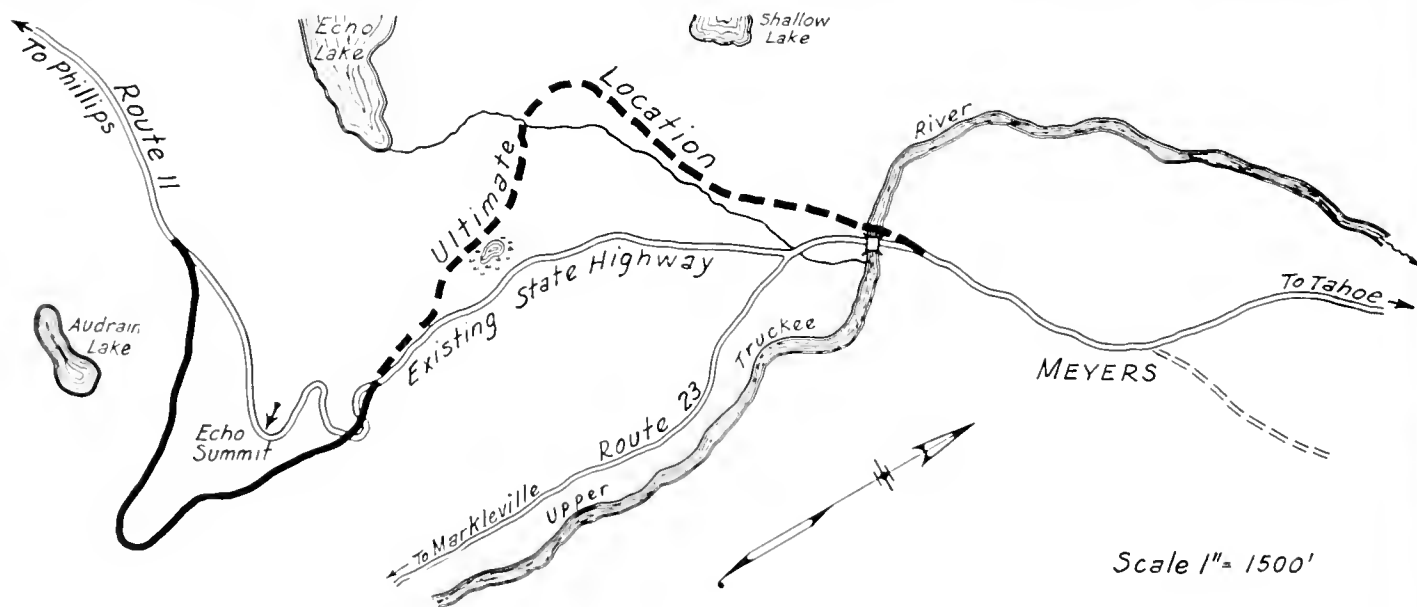
grated granite secured from a pit near the project.

The contractor had placed most of the imported surfacing material and was just starting to mix when inclement weather set in and he was forced to suspend operations for the winter. Work was resumed in June of this year.

Instead of mixing the surfacing in the conventional manner, with blades, the contractor elected to use a bituminous mixing machine. This machine picks up the aggregate from a single windrow along one side of the road, adds the bituminous binder, mixes the two materials and discharges the mixed surfacing in a single windrow behind the machine. The material is then spread and rolled in the usual manner. By using such a machine the contractor was able to maintain closer control over the oil-aggregate ratio than is possible with the conventional road-mixing methods.

The cost of the surfacing contract will be about \$14,000. Mr. R. I. Nicholson has been the resident engineer for the State.

The revised highway departs from the existing road two miles east of Phillips Station, trending southeast-



Black line shows newly opened sector at Echo Summit of Meyers Grade relocation on U. S. 50.

erly on easy grade through timbered land to a small pass in the ridge east of the existing highway summit, at a site where the old Hawley Grade wagon road passed. That road was built in 1858 to provide a shorter route to the gold country and was used till 1861.

From the Hawley Grade crossing the new construction descends to a point on the present Meyers Grade below the switchbacks. It eliminates the present switchbacks, poor curvature, and the steep grades on the superseded stretch. Eventually the relocation will be extended to modernize the entire length of Meyers Grade to the lake valley.

ALONG STEEP BLUFFS

West of the summit no difficult construction was involved in obtaining excellent roadway standards. From the summit to the easterly end of the contract, one mile, the work passes through irregular rock bluffs that top the steep slopes high above the valley floor. On this mile the design and construction of a roadway for a 24-foot crown width of surface presented a difficult problem. Solid benching, retaining walls and concrete bridging were the practical means of providing roadway. At only several places would fills hold and in these places but to limited extent.

The desire to keep construction scars to the minimum on this recreation route influenced design and affected construction methods. Cabins and lodges along the brink of the crest above the highway location increased difficulties. Careful attention is being given to landscaping.

As construction operations proceeded, the excavation lines in the high cutting of the fractured rock formation east of the summit have in general held unusually close to neat cross-section, avoiding excessive overbreak and resultant waste scars.

MASONRY ROADWAY WALLS

Careful engineering and construction work are evidenced. Cement rubble masonry walls maintain support for much of the roadway in critical stretches, with design of these features well in keeping with the character of the country traversed.

The new construction is a spectacular section of the Tahoe Highway. Coming from the west the motorist passes from an avenue of virgin timber to a vista overlooking the pano-

(Continued on page 28)



View of Echo Summit relocation looking toward Lake Tahoe in background.

Walter Chambers Takes Office As Highway Commission Secretary

WALTER CHAMBERS, former Administrator of the State Relief Administration, is the new Secretary of the California Highway Commission, succeeding Byron N. Scott who resigned the position on June 28, 1940.

Mr. Chambers was born in Los Angeles in 1898, and is red-headed, brown eyed, and weighs 172 pounds. He is 5 feet 6 inches tall and was a star basketball player. His father was Edward Chambers and his mother Marion Johnson. They came from Illinois as bride and groom.

Edward Chambers was the first agent of the Santa Fe Railroad at San Diego and later was first agent at Los Angeles. He went up the ladder to the high post of vice president of the Santa Fe. He was one of the big men in railroading in the United States and spent many years in Washington, D. C., where he was a member of the War Industries Board during the world war.

MAJORED IN LAW

Walter Chambers spent some years with his father in Washington, and attended the Catholic University of America in Washington, D. C., where he majored in law, philosophy and economics.

America's entry into the war in 1917 brought an interruption to his studies. He enlisted in the ranks and soon was promoted and placed in charge of all railroad traffic (war) in the Cleveland, Ohio, industrial district and in all of northern Ohio and Pennsylvania.

Service in France came next, Chambers being assigned to the railroad transportation section under Colonel Hal Rey and General Harbord. After the armistice he was assigned to duty with the American Peace Commission in Paris, France, and later joined the staff of the American Relief Administration which disbursed aid from the Baltic Sea to the Balkans.

WAS CORPORATION PRESIDENT

His work in Europe finished, Chambers returned to America, completed his college courses and engaged in personal business working for several



WALTER CHAMBERS

large corporations. After his father's death he became vice president of the Edward Chambers Corporation, with headquarters in Los Angeles.

For several years he was coast representative for one of the largest printing companies in the United States handling large contracts for national magazines, catalogues for chain stores, city directories, etc.

Since coming back to California 13 years ago, he has taken an intensive interest in welfare work in many fields.

He became interested in the migratory problem and was a member of the Citizens Committee of the Federal Transient Commission, he also served on the Board of the Travelers Aid Society and was chairman of the Family Division of the Council of Social Agencies, concerned with the financing of 68 welfare agencies of Los Angeles.

He was chairman of other welfare committees and service groups in Los

Angeles, including a section of the Public Welfare Institute of Government of the University of Southern California and membership on the board of Catholic Youth's Organization.

In July, 1939, when Governor Culbert L. Olson and Dr. H. Dewey Anderson agreed upon a man to become Director of Personnel in the State Relief Administration, that man was Walter Chambers, and he was appointed with the approval of Governor Olson.

On August 14, 1939, upon the resignation of Dr. Anderson as State Relief Administrator, Governor Olson appointed Chambers to that post, which he held until appointed Secretary of the Highway Commission with the approval of Governor Olson.

Three Central Valley Project Milestones

(Continued from page 5)

5, 1939. When completed in 1943 it will be the fourth largest dam of its type in the world. It will be 3,500 feet long across the crest and 320 feet high. Behind it a 15-mile long lake will be formed covering 4,500 acres and storing 520,000 acre-feet of water. This water will be distributed through two canals with a total length of 200 miles.

Preceding the afternoon ceremonies an informal luncheon was held in the Griffith & Bent headquarters at the dam site. Among those attending the luncheon were: Walker R. Young, supervising engineer for the Bureau of Reclamation; Roy B. Williams, construction engineer in charge of the Friant Division; M. H. Sloeum, superintendent for Griffith & Bent; Judge A. R. Donald, legal representative for the Bureau of Reclamation; Clarence Breuner and Roland Curran, president and secretary of the Central Valley Project Association; James R. Fauver, chairman of the Tulare County Water Commission.

Director Clark Tells Achievements Of Department of Public Works

The following article is a radio address made by Director of Public Works Frank W. Clark on Sunday evening July 21st, when he substituted for Governor Culbert L. Olson at the Governor's request. In his address Director Clark discusses the policy of the Department of Public Works under Governor Olson's administration and some of the large projects already accomplished, under way or planned for the future.

By FRANK W. CLARK, Director of Public Works

WHEN Governor Olson requested me to represent him on his regular Sunday evening radio broadcast, I told him that I greatly appreciated the compliment and the honor, and also that I would welcome the opportunity to talk to the people of California about the policies, achievements and program of the Department of Public Works under his administration.

I first want to say that in my opinion any State or Federal administration should be, and in the final analysis is, judged by that which it actually does, and also by that which it sincerely endeavors to do for the benefit of its people as a whole.

Your present State administration is proud of its actual accomplishments to date and equally proud of the record it has made in its determination to provide legislation that will bring to the average man, woman, and child of this State the full benefits of a true working democracy.

PUBLIC REAPING BENEFIT

The accomplishments referred to have been brought about in spite of the opposition, and almost constant refusal of the majority of the State legislature to support or adopt soundly progressive and seriously needed legislation. However, tremendous benefits are now accruing and are being transmitted to the citizens and taxpayers of California through far reaching improvements in the operating efficiency of those State agencies controlled and directed by departmental heads selected by this administration.

As Director of Public Works of

the State of California, I take pleasure in reporting particularly to those of you who are California residents, a few pertinent facts regarding the conduct of this department, which receives and expends approximately \$50,000,000 of your money each year.

The Department of Public Works, the largest agency of the State Government, employing over six thousand people, is made up of five divisions; namely, Division of Highways, Division of Water Resources, Division of Architecture, San Francisco-Oakland Bay Bridge Division, and the Division of Contracts and Rights of Way.

Upon the Division of Highways devolve the maintenance and improvement of 14,000 miles of roads and some 4,000 bridges in the State Highway System, and the construction of all new highway and bridge projects. In the carrying out of these functions the Division of Highways will spend approximately \$42,000,000 this year.

DIVISION OF WATER RESOURCES

The Division of Water Resources is in charge of all work looking to the conservation of the State's water supplies both privately and publicly controlled and has supervision over 605 dams behind which is impounded the waters so valuable to the great interior valleys and the towns and the cities of California.

Because of my previous close relationship in private business with irrigation and drainage matters, and having had occasion to familiarize myself with the condition existing in the State of California pertaining to water laws in general, one of the

earliest official steps which I took was to definitely concern myself with the problems relating to the conservation and proper utilization of our most precious natural resource—the waters originating in our watersheds and comprising the streams of the State of California. Never, in the entire 91-year history of this State has there existed a clearly defined and progressive water conservation procedure based on the theory that the people of California are the owners of the surplus water in the streams.

In the absence of such a program it was common practice for water to be allowed to actually run to waste by owners with technical prior ownership rights while other users were not even permitted sufficient water for their own domestic use.

OWNED BY THE PEOPLE

Having in mind the principle that those public waters are owned by the people at large, I directed an investigation designed to develop a definite recommendation for legislation which would give to the State the power to insure the fullest and most advantageous use possible of all of the waters of California.

I can now report that through the efforts of this administration the "Police Power Amendment" to the California Water Commission Act was enacted and became law when Governor Olson signed it.

By reason of this amendment for the first time in the history of California the people of the State through the Department of Public Works have the necessary legal power and therefore now are able to properly protect and fully preserve

their rights in the water within our State.

The Police Power Amendment reads as follows:

"This act is hereby declared to be in furtherance of the policy contained in the Constitution of the State of California and in all respects for the welfare and benefit of the people of the State, for the improvement of their prosperity and their living conditions."

PROTECTS THE PUBLIC

This new amendment to the Water Commission Act allows the Department to reject any application for the use of water when in its judgment the proposed appropriation is contrary to the public interest. This means that the Department of Public Works may now safely guard the water rights of this State for the future, being assured of its ability to recover certain water rights by recapture procedure which will result in making such water again available to the State to be used for greatest public benefit.

As you know, one of the world's most monumental undertakings for the conservation of water is the Central Valley Project which ultimately will restore to fertility many thousands of acres of arid lands in the San Joaquin Valley. The price of this water to the farmers of the Sacramento and the San Joaquin Valleys will be largely determined by the sale of power generated at Shasta Dam.

In this connection it is gratifying to be able to report that at the request of Governor Olson and myself as Chairman of Water Project Authority, Harold L. Ickes, Secretary of the Interior, has now approved a conference between members of the authority and representatives of the United States Bureau of Reclamation, to be held next month for the purpose of clarifying the responsibilities of the Federal Government and the State relative to the distribution of Shasta Dam power.

I take the liberty of quoting from a letter from Secretary Ickes on this subject. Secretary Ickes said, quote:

"I am sure that the conference will prove helpful both to the Bureau of Reclamation and the Water Project Authority and I am hoping that a permanent plan may result by which the power to be generated by the Central Valley Project can be mar-

keted to and distributed through public agencies." End quote.

We anticipate that this conference will further to a great extent the program of public distribution and sale of Shasta Dam power—a program for which Governor Olson has fought vigorously since his induction into the office of Chief Executive of California.

BRIDGE TOLLS REDUCED

The Department of Public Works constructed a seventy-three million dollar over-water span across San Francisco Bay, and through its San Francisco-Oakland Bay Bridge Division maintains and operates this renowned structure. In this connection I may say that since Governor Olson's election the California Toll Bridge Authority, of which he is Chairman, has made four successive bridge toll reductions, the toll for passenger cars now being twenty-five cents, just one-half of what they were when this administration assumed office. Almost immediately this administration opened negotiations with the Reconstruction Finance Corporation of the Federal Government, during which we finally were able to make certain refinancing contract adjustments and gained concessions that actually amounted to reducing the financial carrying charges on the San Francisco-Oakland Bay Bridge by almost one million dollars per year. This huge annual savings has, of course, had much to do with the cutting in half of the tolls on this, the world's largest bridge.

Certainly this is an outstanding example of what can be accomplished for the people in the public utility field under government ownership. We hope to further expand such benefits.

Because of the determination of this administration to increase the operating efficiency of every department to the highest possible degree a detailed examination and complete survey has been made of each one of the above divisions and a current report system is in effect. The duties of every employee are analyzed, the use of every car investigated, and the expenditure of every dollar scrutinized.

Much is being accomplished under this program. Generally speaking I am happy to say that we are receiving very satisfactory cooperation

from the civil service employees themselves.

IMPORTANT LABOR CLAUSE

In all divisions we are insisting that construction work done by contract method be entered into only after such steps have been taken as to assure full and open competitive bidding in every sense of the word, and at the same time strictly enforcing all contract stipulations and specifications, including the important labor clause which provides that not less than established prevailing wages must be paid all workers under every contract.

TRAFFIC CONGESTION IN CITIES

Because all Californians are known to be highway minded, I would like to add to what I have already said relative to the functions of the Division of Highways. The transition of a large rural population to a nation of city dwellers, of transportation from the horse and buggy to automobiles, has resulted in traffic congestion within our larger municipalities which has become a major national problem which demands an immediate solution. It has been found that the mere widening of city arteries is of little or no avail, because the intersection remains to paralyze traffic movements.

All signs now point to the construction of urban motor ways or freeways as the solution of city traffic problems. The motor way is a multi-lane street with opposing traffic separated by a dividing strip with no intersecting streets and to which access is limited to a few points. Freeways already constructed in such centers as New York and Chicago give promise that relief is in sight.

This State will from now on concern itself more and more with traffic problems within incorporated cities. In my opinion this is as much the responsibility of the State as the cities themselves. In doing this, the State does not contemplate neglecting rural areas. I have recently ordered a statewide survey of traffic congestion conditions and when our program in this respect is worked out it will be of equal benefit to rural communities throughout California and will not be confined to the congested areas within large cities.

Chaotic conditions arising from the growing demoralization of transportation within urban centers is not only increasing the hazards to life and property but it is also causing great inefficiency and economic losses by retarding the growth and development of our cities. In the interest of public safety, of efficiency, of economy and of progress, adequate motorway facilities within and through urban areas must be immediately anticipated. To accomplish this the State and cities must cooperate in the construction of such public thoroughfares.

In California the Department of Public Works through its Division of Highways will do its share in meeting the State's urban traffic needs. Between Los Angeles and Pasadena construction of arroyo Seco Parkway is now nearing completion. Only yesterday, a three and seven-tenths mile section of this freeway—from Avenue 40 in Los Angeles to Orange Grove Avenue in Pasadena—was opened to traffic. This six mile project with its 28 bridges and grade separations, in the building of which the State had the cooperation of the cities of Los Angeles, Pasadena, and the Federal Government, will cost about twelve million dollars.

In another part of the city the first section of the Cahuenga Freeway has just been opened to public traffic. This also is a cooperative project with the State, City, and Federal Government participating.

BAYSHORE FREEWAY PLANS

In the north we now have under way a survey for the changing of 27 miles of the Bay Shore Highway between San Francisco and Palo Alto into a modern motor freeway. The plan for this arterial is to provide two 35-foot freeways with 21 grade separations and no surface intersections.

I am greatly concerned over the increasing traffic congestion in the western sections of Los Angeles. This week I ordered a comparative survey of traffic on the west side with especial attention to be paid to Wilshire Boulevard, Olympic Boulevard and Santa Monica Boulevard, and traffic flowing from the San Fernando Valley and Hollywood areas. The State of California will lend all possible assistance to the

Bay Bridge Traffic for July Reaches All-time High of 1,533,929 Vehicles

JULY traffic on the San Francisco-Oakland Bay Bridge continued the acceleration displayed in May and June and reached an all-time high for a one-month period with 1,533,929 vehicles.

The increase over July of 1939 was 440,427 vehicles, or 40.3 per cent. This increased travel, however, was not accompanied by an increase in revenue which dropped \$46,634. This reflects the present average toll of 27.4 cents compared with 42.7 cents one year ago. The average toll in July of last year was 56 per cent greater than it is today.

The record traffic for the month was accompanied by some unusually

heavy traffic on weekends, showing a Sunday average of 57,769 with a high of 59,828 on July 21.

A year ago traffic to Treasure Island totaled 242,191 cars compared with 234,527 during July of this year. The slight reduction is attributed to the popularity of bus service to the exposition rather than to a decrease in patronage. However, this decreased travel to Treasure Island does indicate an even greater increase of normal traffic using the bridge than the 40.3 per cent cited above.

July traffic on the San Francisco-Oakland Bay Bridge and comparative figures are:

	July 1940	July 1939	June 1940	Total Since Opening
Passenger autos and auto trailers -----	1,413,564	1,011,424	1,258,403	34,731,883
Motorcycles and tricars -----	4,588	4,376	4,681	155,743
Buses -----	26,547	17,327	25,528	582,702
Trucks and truck trailers -----	68,421	44,850	57,174	1,685,143
Others -----	20,809	15,525	19,155	590,741
Total vehicles -----	1,533,929	1,093,502	1,364,941	37,746,212

City of Los Angeles in solving the problem of this critical traffic situation. The State is hopeful that its immediate and future highway planning in Los Angeles, San Francisco, Oakland, and our other larger cities, will be so developed as to materially assist them in handling the ever increasing flow of traffic into their metropolitan areas.

During this brief talk I have tried to bring to your personal attention only a few of the many important and definite departmental steps, which are being taken by your present State government under the able leadership of Governor Olson, and which I sincerely trust will be accepted by you as citizens and taxpayers of this State as an indication of our desire and determination to efficiently and faithfully serve you.

It happened at the spring training camp of a major league baseball club.

Gatekeeper (to the manager)—The umpire for today's game is at the gate with two friends. Shall I pass them in?

Manager (gasping)—An umpire with two friends? Sure!

Bayshore Freeway Plan Urged

(Continued from page 9)

resident of San Mateo County, with my business interests in San Francisco, I have had occasion, over a period of years to travel the Bayshore Highway at least twice a day, and I know the hazards to motorists that exist there today.

I think the launching of this project will be hailed as one of the outstanding achievements of the present state administration.

Oildale Bridge Prospects

Director of Public Works Frank W. Clark has notified Senator James Hollister, Gaviota, and Supervisor Ralph Lavin of Bakersfield that the Division of Highways anticipates being in a position to start construction of the new Oildale Bridge across Kern River, and the realignment of the highway through Oildale sometime during the latter part of November.

The Bridge Department of the Division of Highways, which is preparing plans and specifications for the proposed Oildale Bridge, expects this project will be ready for advertising of bids about October 1.

Importance of Traffic Accident Reports Shown

By J. W. VICKREY, Safety Engineer

REAL PROGRESS in reducing the toll of traffic accidents depends in no small degree on traffic accident reports. The California vehicle code requires that an accident report be made for every motor vehicle accident resulting in injury or death of any person. It is essential, further, in order to effect any substantial reduction in economic loss and physical suffering occasioned by this blight on motor transportation, that the facts contained in the accident reports be available and in readily usable form.

All too frequently a communication is received, calling attention to a certain allegedly hazardous spot and more particularly pointing out that Mr. A or Mrs. B, or an employee, was injured in a recent accident at that spot—and always “Why doesn’t somebody do something?” A check shows that not only was that particular accident not reported but there are no reports on file of accidents occurring at that particular place.

Information contained in all accident reports on file forms the base upon which any effective program looking toward correction must be founded. The report forms have been painstakingly worked out so that the information necessary will be made available.

Reliable records show that the traffic accident toll, calculated in terms of miles traveled, is being reduced. There is every reason to believe that this toll can be reduced at a more rapid rate. The first step in bringing about this desirable reduction is complete, accurate accident reports, not only the reports required by law but also those in which only property damage occurs; for, after all, whether a collision results in a fatality or only a smashed car, is a matter of chance, the odds of which can not be calculated.

Hotel Page: “Telegram for Mr. Niespondiavanci, telegram for Mr. Niespondiavanci?”

Mr. Niespondiavanci: “What initial, please?”

Department of Public Works Will Exhibit at State Fair

“**A**LL roads lead to Rome.” So went the old saying, but the modern version is that all highways lead to the California State Fair, which opens at Sacramento August 30 and runs for 11 days, closing September 9.

Converging on Sacramento are U. S. 40, 50, 99, 99E, 99W; State Sign Routes 16 and 24, which will be crowded with automobiles during the fair dates, while all other roads, railroads, bus lines and air lines will bring their human cargoes.

California’s highways, by far, carry the heaviest load of fair visitors, for Californians depend on the State’s excellent road program for transportation.

PUBLIC WORKS EXHIBIT

The varied activities of the Department of Public Works will be depicted in an exhibit prepared by the department and the California State Employees Association.

Frank W. Clark, director of Public Works, announced that in addition to the regular activities of the Division of Highways, the Division of Water Resources and the Division of Architecture, part of the exhibit will be devoted to the Central Valley Project.

Colored moving pictures, showing the rapid progress which is being made in the construction of this \$228,000,000 conservation project will be a feature of the exhibit. Such recent events as the first pouring of concrete at Shasta Dam and at Friant Dam, and the beginning of pumping operations on the Contra Costa Canal will be shown.

HIGHWAY MODELS SHOWN

In addition scale models of bridges and overpasses recently constructed by the Division of Highways, colored photographs of the new high speed Freeways and equipment used by the Division in its testing laboratories will be shown.

The exhibit will be with the group of Federal and State exhibits in the grandstand building.

At the State Fair, visitors will see more than America’s largest agri-

cultural show. All of California’s 228 economic crops will be displayed by the 29 counties participating. The machinery exhibit is the best in the west, while the horse show, with five new classes added and an old favorite revived, is the premier of such events on the Pacific coast.

For relaxation, the State Fair offers the tops in entertainment. Three of the nation’s biggest “name” bands, Kay Kyser, Horace Heidt and Orrin Tucker, head the exceptional bill. Kyser will open the fair, playing the first three days, and Heidt and Tucker will play four days each. Each orchestra will offer a night show in front of the grandstand and play for dancing later in Governor’s Hall.

FOURTEEN NEW BUILDINGS

The new junior division is a good-sized fair in itself. The 14 new buildings, erected on a recently acquired 60-acre tract, are for the exclusive use of the Future Farmers of America and the 4-H Club boys and girls.

The \$2,000,000 live stock parade is a highlight of the fair, and the many special events will provide a continuous round of things to see.

The outstanding speed program will delight the horse fans. Entered in the running races are track stars from such stables as C. S. Howard, A. G. Tarn and the Rancho San Luis Rey, while in the harness events will be fast steppers from the S. H. Cowell and Mrs. Elmo Montgomery stables as well as other popular favorites.

Another improvement at the fair grounds is in the parking facilities. Space has been added to the north parking area for approximately 500 more cars, while the Fifth Avenue parking area has been improved by planting one-half in Bermuda sod, thus eliminating much of the dust of former years.

“Is the Secretary of Agriculture in?”

“I’ll see, madam. What do you wish to see him about?”

“Well, I have a geranium that isn’t doing as well as it should.”—Hudson Star.



READING FOR EMPLOYEES
PIONEER TITLE INSURANCE AND
TRUST COMPANY

San Bernardino, Calif.

Editor,
 California Highways
 and Public Works,
 Sacramento, California.

Dear Sir:

We appreciate very much receiving your magazine. Copies will always be with reading matter in our lobby and in our employees' lounge and I assure you the undersigned will check each issue personally. I find it very interesting.

Very truly yours,

C. K. COOPER,
 First Vice President

UNIVERSITY OF CALIFORNIA

Department of

Physical Education for Men

Berkeley, Calif.

Editor,
 California Highways
 and Public Works,
 Sacramento, California.

Dear Sir:

Recently while in Calistoga, I had the pleasure of reading several copies of your excellent magazine at the Public Library.

They are so instructional and interesting that I would like very much to have you place my name on your mailing list.

Yours truly,

Heber Newson
 Asst. Sup. of P.E. for Men

FROM FELLOW CRAFTSMAN

ALLIED SACRAMENTO VALLEY
NEWSPAPERS

Colusa, California

J. W. Howe, Editor
 California Highways
 and Public Works,

Dear Mr. Howe:

Thanks for loaning us cuts on District 70 levee break, which were printed in the Sun-Herald. I am returning same at once. Copy of paper containing the feature is also being mailed.

May I congratulate you upon the general excellence of California Highways and Public Works. In past years I sel-

dom paid any attention to the magazine. Now it's on my "must read" list.

Thanks again,

Cordially yours,

(Signed) Wilmer G. Brill
 The Colusa Sun-Herald

PUBLIC LIBRARY REQUEST

NEWHALL BRANCH LIBRARY

Newhall, Calif.

California Highways
 and Public Works,
 Sacramento, California.

Gentlemen:

The local branch of the Los Angeles County Public Library would appreciate very much receiving "California Highways and Public Works" for our branch. Would you be so kind as to forward it to us in the future.

Mailing address is:

Newhall Branch
 L. A. County Public Library,
 Newhall, Calif.

Thanking you in anticipation, I am

Respectfully yours,

Mary F. Brunner

EDITOR IS CONGRATULATED

DIVISION OF REAL ESTATE

Los Angeles, California

Editor,
 California Highways
 and Public Works,
 Sacramento, California.

Dear Sir:

I greatly appreciate the magazine mailed to me for the month of May 1940. I have been receiving them from time to time. They are very interesting, instructive, and thoroughly enjoyed by me.

I congratulate you upon the publication of this splendid magazine.

Sincerely yours,

CLARENCE URBAN
 REAL ESTATE COMMISSION
 OF CALIFORNIA

CHAIRMAN BARRETT FLIES

Chairman Lawrence Barrett, of the California Highway Commission, made an aerial trip on the Clipper to Honolulu July 30th where his family had been sojourning for a month. They returned together August 7th on the steamship.

TRAVELS TO GET IT

SULLY MILLER CONTRACTING
COMPANY

Long Beach, California

Editor,
 California Highways
 and Public Works,
 Sacramento, California.

Dear Sir:

Our Long Beach office received the "California Highways and Public Works" each month and I find it so interesting that I must make an extra trip to Long Beach each month to read it.

Is it possible for the Orange office, RD No. 1, Box 627, Orange, to be placed on your mailing list? I would appreciate it very much if you find it possible to accommodate us.

Yours truly,

Sully-Miller Contracting Co.

By _____
 W. F. Halley

FOUNTAIN OF INFORMATION

Bakersfield, California

California Highways
 and Public Works,
 P. O. Box 1499,
 Sacramento, California.

Gentlemen:

I have read several of your magazines with great interest and enjoyment. The articles and photographs contained in your publications afford the readers thereof an opportunity to become better acquainted with the State of California; and, being a "native," I am more than interested in the progress and development of our State. "California Highways and Public Works" is truly a fountain of information as to the progress and development being carried on in this State, and for that reason I should greatly appreciate receiving your magazine. May I have a place on your mailing list.

Very truly yours,

Ruby M. Reynolds
 2131 Baker Street,
 Bakersfield, Calif.

Two heavyweight boxers chasing each other round the ring kept treading on the toes of the small referee. At last he lost patience and shouted:

"If you guys don't stop treading on my corns there's going to be a fight!"

Highway Bids and Awards for the Month of July, 1940

BUTTE, PLACER, YOLO, COLUSA, SUTTER, GLENN AND YUBA COUNTIES—At various locations, about 38.5 miles in length, seal coat to be applied. District III, various routes. Claude C. Wood, Lodi, \$17,282; Brown & Doko, Pismo Beach, \$17,890; A. S. Vinnell Co., Alhambra, \$19,910. Contract awarded to Granite Construction Company, Watsonville, \$15,944.20.

COLUSA COUNTY—Between 2 1/2 miles east of Williams and Colusa, about 5.6 miles in length, to be graded and surfaced with plant-mix surfacing on gravel base, and a reinforced concrete bridge is to be widened. District III, Route 15, a, clu. M. J. B. Construction Co., Stockton, \$104,235; Hemstreet & Bell, Marysville, \$108,624; Basich Brothers, Torrance, \$114,095; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$123,359; Jones & King, Hayward, \$125,574; Marshall S. Hanrahan, Redwood City, \$132,455. Contract awarded to Valley Construction Co., San Jose, \$88,168.75.

FRESNO-MADERA COUNTIES—Two reinforced concrete bridges, one across San Joaquin River and the other across San Joaquin River Overflow to be constructed. District VI, Route 125, Section C, A. Earl W. Heple, San Jose, \$142,745; E. E. Smith, Berkeley, \$142,940; C. W. Caletti & Company, San Rafael, \$146,380; R. R. Bishop and R. B. Wood, Long Beach, \$148,724; Trewitt-Shields & Fisher, Fresno, \$153,542; Engineers, Limited, Sacramento, \$161,631; J. S. Metzger & Son, Los Angeles, \$162,516; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$162,620; Carlo Bongiovanni, Hollywood, \$178,888. Contract awarded to Campbell Construction Co., Sacramento, \$134,935.60.

FRESNO-MADERA COUNTIES—Between 0.5 mile south and 1.6 miles north of San Joaquin River, about 2 miles in length to be graded. District VI, Route 125, Sections C, A. Fredrickson Bros., Emeryville, \$55,259; Louis Biasotti & Son, Stockton, \$55,298; M. J. B. Construction Co., Stockton, \$57,171; A. Teichert & Son, Inc., Sacramento, \$57,623; Valley Construction Co., San Jose, \$60,790; Heafey-Moore Co. & Fredrickson & Watson Const. Co., Oakland, \$60,945; Hemstreet & Bell, Marysville, \$60,964; Piombo Bros. & Co., San Francisco, \$63,606; Fredrickson & Watson, Sacramento, \$64,718; A. S. Vinnell Co., Alhambra, \$66,466; Rexroth & Rexroth, Bakersfield, \$66,862; N. M. Ball Sons, Berkeley, \$77,965; Griffith Company, Los Angeles, \$82,482. Contract awarded to Earl W. Heple, San Jose, \$47,047.

GLENN-BUTTE COUNTIES—Between Butte City and Cherokee Canal, about 12.4 miles in length, road-mix surface treatment to be applied. District III, Route 45, Sections, C, A. Fredrickson & Westbrook, Sacramento, \$20,789; J. A. Casson Co., Hayward, \$20,825; Frank Embleton, Albany, \$21,280; L. C. Karstedt, Watsonville, \$22,652; A. S. Vinnell Co., Alhambra, \$23,099; Claud C. Wood, Lodi, \$26,200. Contract awarded to Oilfields Trucking Company, Bakersfield, \$18,000.80.

IMPERIAL COUNTY—Between Mountain Springs and 3.6 miles easterly about 3.6 miles in length to be graded and road-mix surface treatment applied thereto. District XI, Route 12, Section A. A. S. Vinnell Co. & J. S. Metzger & Son, Alhambra, \$288,501; Macco Construction Co., Clearwater, \$420,524; Oswald Bros., Los Angeles, \$422,646; United Concrete Pipe Corp., Los Angeles, \$442,810; Griffith Co., Los Angeles, \$488,589; Daley Corp., San Diego, \$494,839;

V. R. Dennis Const. Co., San Diego, \$531,020; J. E. Haddock, Ltd., Pasadena, \$579,941. Contract awarded to Danni Investment Corp., Wilmington, \$367,864.90.

KERN COUNTY—Between Route 143 east of Sivert, about 7.1 miles in length to be graded and surfaced with crusher run base and plant-mix surfacing. District VI, Route 58, Section C. Macco Construction Company, Clearwater, \$112,981; Piazza & Huntley, San Jose, \$120,887; Marshall S. Hanrahan, Redwood City, \$125,245; Louis Biasotti & Son, Stockton, \$127,761; A. Teichert & Son, Inc., Sacramento, \$132,280. Contract awarded to Basich Brothers, Torrance, \$111,706.50.

LAKE COUNTY—Between 3 miles and 5.3 miles northeast of Putah Creek about 2.3 miles in length to be graded and an Armor Coat applied. District I, Route 49, Section B. Fredrickson and Westbrook, Sacramento, \$96,496; Piombo Bros. & Co., San Francisco, \$99,722; Louis Biasotti & Son & L. D. Tonn, Stockton, \$99,777; Hemstreet & Bell, Marysville, \$108,798; N. M. Ball Sons, Berkeley, \$111,489; Heafey-Moore Co., Fredrickson & Watson Construction Co., Oakland, \$120,138; A. Teichert & Son, Inc., Sacramento, \$120,619; Fredrickson Bros., Emeryville, \$122,040. Contract awarded to J. L. Conner and Sons, Point Arena, \$91,469.20.

LOS ANGELES COUNTY—Between Brents Junction and Liberty Grade about 1 mile in length to be graded and plant-mix surfacing to be placed over existing pavement and new roadbed. District VII, Route 2, Section C. Basich Bros., Torrance, \$28,050; Griffith Co., Los Angeles, \$28,575; Claude Fisher Co., Ltd., Los Angeles, \$29,692; Oswald Bros., Los Angeles, \$33,801; F. Gunner Gramatky, Pasadena, \$37,946. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$26,850.25.

LOS ANGELES AND ORANGE COUNTIES—11.7 Miles road-mix surface treatment between Siphon Road and Garvey Blvd., between Brea Can. Road and west end of Section and between Olinda and Orange-San Bernardino County line. District VII, Routes 168, 172, 177, Sections B, C, A. A. S. Vinnell Co., Alhambra, \$14,008; C. R. Butterfield-Kennedy Co., San Pedro, \$16,497. Contract awarded to Dimmitt & Taylor, Los Angeles, \$10,844.

MARIN COUNTY—Between San Rafael and Richardson Bay Bridge about 5.5 miles in length to be graded and surfaced with plant-mix surfacing on crusher run base. District IV, Route 1, Section C. A. Teichert & Son, Inc., Sacramento, \$258,643; Heafey-Moore Co. & Fredrickson & Watson Const. Co., Oakland, \$272,260; Fredrickson and Westbrook, Sacramento, \$273,184; Chas. L. Harney, San Rafael, \$284,135. Contract awarded to A. G. Raisch, San Francisco, \$251,503.50.

MENDOCINO COUNTY—Between Heagneys and 0.5 mile north of Lanes about 1.4 mile in length to be graded and surfaced with plant-mix surfacing. District I, Route 1, Section J. Claude C. Wood, Lodi, \$95,835. Contract awarded to N. M. Ball & Sons, Berkeley, \$92,742.60.

MODOC COUNTY—Between 4.6 miles south of Cedarville and Cedarville, about 4.6 miles in length to be graded and surfaced with road-mix surfacing. District II, feeder. Fredrickson & Westbrook, Sacramento, \$36,558; Poulos & McEwen, Fort Bidwell, \$36,797; Harms Bros., Sacramento, \$38,791. Contract awarded to Lee J. Immel, Berkeley, \$35,468.20.

MODOC AND SISKIYOU COUNTIES

Between Stronghold and Oregon State line, about 6.8 miles in length, portions to be surfaced with imported borrow, and the entire project to be surfaced with plant-mix surfacing and seal coat applied. District II, feeder. J. A. Casson Co., Hayward, \$60,775; Fredrickson & Westbrook, Sacramento, \$71,198. Contract awarded to Harms Bros. and N. M. Ball Sons, Berkeley, \$57,391.

MONTEREY COUNTY—At various locations between the southerly boundary and Big Sur River, about 17 miles in length; beam type metal guard railing and timber guide posts to be furnished and installed. District V, Route 56, Sections A, B, C, D, E. Oberg Bros., Los Angeles, \$79,926; N. M. Ball Sons & E. E. Smith, Berkeley, \$79,989; George Pollock Co., Sacramento, \$81,279; Claude C. Wood & L. D. Tonn, Lodi, \$81,960; A. Teichert & Sons, Inc., Sacramento, \$83,985; Fredrickson & Westbrook, Sacramento, \$84,368; Trewitt-Shields & Fisher, Fresno, \$86,628; Granite Construction Company, Watsonville, \$87,626; M. J. B. Construction Co., Stockton, \$87,905; Werner & Webb, Los Angeles, \$111,751; Sander Pearson, Santa Monica, \$107,820; E. T. Lesure, Oakland, \$111,882. Contract awarded to Union Paving Co., San Francisco, \$76,514.83.

NAPA COUNTY—Between 7 miles and 24 miles north of Napa, 6 masonry arches to be extended. District IV, Route 49, Sections B, C, C. C. Gildersleeve, Berkeley, \$15,801. Contract awarded to Harold Smith, St. Helena, \$14,924.60.

PLACER, EL DORADO, SACRAMENTO, NEVADA AND SIERRA COUNTIES—At various locations, about 37.5 miles in length, seal coat to be applied. District III, various routes and sections. Pacific Truck Service, Inc., San Jose, \$24,584; A. Teichert & Son, Inc., Sacramento, \$25,294; Sheldon Oil Co., Suisun, \$31,192. Contract awarded to Granite Construction Company, Watsonville, \$23,478.

RIVERSIDE COUNTY—Stockpile pit-run gravel base, surfacing, and binder or filler in windrows on shoulders between Palo Verde and Junction Route 64. District XI, Route 146, Sections A and B. H. L. Miller, Hemet, \$7,665; A. C. Bussey, Riverside, \$7,200. Contract awarded to R. E. Hazard & Sons, San Diego, \$5,642.50.

SAN BERNARDINO-RIVERSIDE COUNTIES—At various locations in District VIII, about 56.8 miles in length, seal coat to be applied. District VIII at various locations. Matich Bros., Elsinore, \$23,992; E. L. Yeager, Riverside, \$24,712; Brown & Doko, Pismo Beach, \$24,940; A. L. Gabrielson, Arlington, \$27,910; Basich Bros., Torrance, \$29,611; Dimmitt & Taylor, Los Angeles, \$41,060. Contract awarded to R. E. Hazard & Sons, San Diego, \$23,682.50.

SANTA CLARA COUNTY—On El Camino Real under University Avenue at Palo Alto, a reinforced concrete underpass on spread footings to be constructed. District IV, Route 2, Section A. Dan Caputo, San Jose, \$50,273; Engineers Limited, San Francisco, \$55,929; S. J. Amoroso Const. Co., San Francisco, \$56,538; Paul J. Tyler, Oroville, \$56,986; Union Paving Co., San Francisco, \$62,760. Contract awarded to Earl W. Heple, San Jose, \$46,367.50.

SHASTA COUNTY—Between Central Valley and Shasta Summit, about 5.0 miles in length to be surfaced with plant-mix surfacing and crusher run base. District II, Routes 3 and 209, Sections B, A. Fredrick-

sen & Westbrook, Sacramento, \$18,953; A. Teichert & Son, Inc., Sacramento, \$54,425; N. M. Ball Sons, Berkeley, \$55,110; Marshall S. Hanrahan, Redwood City, \$63,960. Contract awarded to Jones & King, Hayward, \$47,976.

SILASTA COUNTY—Between Redding Underpass and Hill Street in Redding, about 1.1 miles in length to be graded and surfaced with Portland cement concrete pavement and with plant-mix surfacing on crusher run base. District II, Route 3, Sections A, Rdg. N. M. Ball Sons, Berkeley, \$110,116; Hemstreet and Bell, Marysville, \$122,750; Marshall S. Hanrahan, Redwood City, \$127,426; Jones and King, Hayward, \$129,217; A. Teichert and Son, Inc., Sacramento, \$131,036. Contract awarded to Fredericksen and Westbrook, Sacramento, \$104,643.75.

SILASTA COUNTY—Sacramento River Bridge north of Redding to be repaired by constructing reinforced concrete abutment on steel piles and (1) structural steel and concrete span 28' long. District II, Route 3, Section B. A. Frederick Anderson, Oakland, \$12,875; Fred J. Maurer & Son, Eureka, \$18,688. Contract awarded to E. E. Smith, Berkeley, \$11,783.

SOLANO COUNTY—Bridge across Sacramento River at Rio Vista, to be repaired. District X, Route 53, Section C. M. A. Jenkins, Sacramento, \$13,883; Thomas Const. Co., Burbank, \$13,573; F. Kaus, Stockton, \$14,173. Contract awarded to Lee J. Immel, Berkeley, \$11,576.30.

SOLANO-YOLO COUNTIES—At points between 0.5 and 3.5 miles south of Davis, 6 R. C. Bridges to be constructed. District X, Route 6, Section A. E. Campbell Construction Co., Sacramento, \$127,087; Engineer's Limited, Sacramento, \$128,529; Fred Maurer & Son, Eureka, \$129,621; Heafey-Moore Co. & Fredericksen & Watson Construction Co., Oakland, \$129,967; M. J. B. Construction Co. and F. Kaus, Stockton, \$130,790; Harry J. Osor, San Francisco, \$133,003; Holdener Construction Company, Sacramento, \$136,442; E. E. Smith, Berkeley, \$140,846; C. W. Caletti & Company, San Rafael, \$141,601; J. S. Metzger & Son, Los Angeles, \$149,592. Contract awarded to E. T. Lesure, Oakland, \$117,396.90.

SONOMA COUNTY—Two miles west of Guerneville, two reinforced concrete slab sidehill viaducts on steel piles, having lengths of 112' and 252' to be constructed. District IV, Route 104, Section A. Harold Smith, St. Helena, \$25,953; Trewitt-Shields and Fisher, Fresno, \$26,273; C. W. Caletti and Company, San Rafael, \$30,925. Contract awarded to Carlton C. Gildersleeve, Berkeley, \$24,378.

SONOMA AND NAPA COUNTIES—Near Wyatts Corner, and between Yenni Ranch and 0.6 mile east of Napa County line, about 2.7 miles in length, about 1.1 miles to be graded and entire project to be surfaced with plant-mix surfacing and seal coat applied. District IV, Routes 8, 104, various sections. Harold Smith, St. Helena, \$72,090; N. M. Ball Sons, Berkeley, \$75,147; Chas. L. Harney, San Francisco, \$87,805; A. Teichert & Son, Inc., Sacramento, \$89,357; J. L. Conner & Sons, Point Arena, \$89,891; A. G. Raich, San Francisco, \$97,128. Contract awarded to E. A. Forde, San Anselmo, \$68,757.83.

TRINITY COUNTY—Across Trinity River near Douglas City, repairing 2 125' steel deck truss spans. District II, Route 20, Section A. Trewitt-Shields & Fisher, Fresno, \$20,650; E. E. Smith, Eureka, \$24,330; A. Frederick Anderson, Oakland, \$27,891; A. Soda & Son, Oakland, \$30,725; Mercer Frazier Company, Eureka, \$33,224. Contract awarded to Fred J. Maurer & Son, Eureka, \$19,900.

VENTURA COUNTY—Between Los Angeles County line and Timber School, about 3.0 miles in length to be graded and plant-

Route of Proposed Bayshore Freeway

(Continued from page 13)

cedero Road south of Palo Alto. The construction of complete grade separation facilities at these various locations will depend upon the location and extent of improvements in this area.

The proposed future separation at Chestnut Street in Redwood City will eliminate the only open railroad crossing remaining on this route, and will also provide crossing facilities for traffic to the industrial area east of the highway.

The area traversed by this section is potential future residential, industrial and urban areas, and although at present undeveloped (except through East Palo Alto), is rapidly being subdivided into residential areas.

At the present time it would appear that the first separations should be considered at junction with Willow Road and University Avenue in Palo Alto, to be followed by structures at Chestnut Street in Redwood City and Embarcadero Road south of Palo Alto. As in previous cases the first stage of divided highway construction without grade separation will greatly increase the safety factor for travel on this highway.

The area through East Palo Alto presents a particularly difficult problem due to the many business establishments now existing on either side of the present road, and will require considerable study for final design.

CARS USE MOST GAS IN AUGUST

A recent report indicates that in 1933, as in 1928, the greatest consumption of gasoline was in August. In that month motorists and others bought an average of 70,514,000 gallons of gasoline a day. Better cars, better roads, and better gasoline apparently have leveled out the use of automobiles and the gasoline demand curve appreciably, however, for even in the lowest month, January, the average daily consumption totaled 49,959,000 gallons. Greatest monthly increase in consumption last year was in June, which recorded a 10.3 per cent gain over June, 1932.

mix surface and Portland cement concrete pavement to be placed. District VII, Route 2, Section A. Basich Bros., Torrance, \$119,321; J. E. Haddock, Ltd., Pasadena, \$124,447; Macco Construction Co., Clearwater, \$125,739; Oswald Bros., Los Angeles, \$126,547; Dimmitt & Taylor, Los Angeles, \$133,004; Sander Pearson, Santa Monica, \$136,340. Contract awarded to Griffith Co., Los Angeles, \$116,193.60.

Keaton Speaker at Opening of Oregon Highway

DEPUTY Director of Public Works, Morgan Keaton, was the official representative of Governor Culbert L. Olson and one of the speakers at the opening of the Willamette Highway in Oregon on July 30th, when the new highway was dedicated with ceremonies at the east entrance to the new highway tunnel at Salt Creek Falls.

The Willamette Highway, which is Oregon Highway 58, begins at a junction with the Pacific Highway about 7 miles south of Eugene and runs in a southeasterly direction to connect with Highway 97, 10 miles south of Crescent. The route then follows Highway 97 to Klamath Falls into California and connects again with Pacific Highway at Weed.

It is claimed that the mileage will be shortened at least 16 miles and the driving time four hours, between Portland and San Francisco.

Meyers Grade Relocation Opened

(Continued from page 19)

rama of the Lake Tahoe basin. The transition is made over a sweeping summit curve, widened and safeguarded.

The descent that follows is on a roadway where width, curvature, grade and sense of security are in marked contrast to the former road. The new road will facilitate maintenance, especially in providing reasonably safe conditions when snow removal is required to keep the route open. Similar road standards will apply when the entire grade can be reconstructed to Meyers.

The Public Road Administration officials in charge of the project are: Dr. L. I. Hewes, chief of Western Region; C. H. Sweetser, District Engineer; Levant Brown, Senior Highway Engineer, in charge of Forest and Park roads construction; E. C. Brown, Senior Highway Engineer, as Supervising Engineer, and M. M. Flint, Resident Engineer.

State of California

CULBERT L. OLSON, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

FRANK W. CLARK, Director of Public Works

FRANZ R. SACHSE, Assistant Director

MORGAN KEATON, Deputy Director

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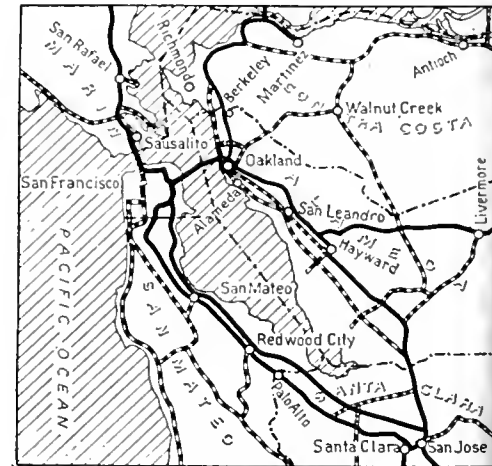
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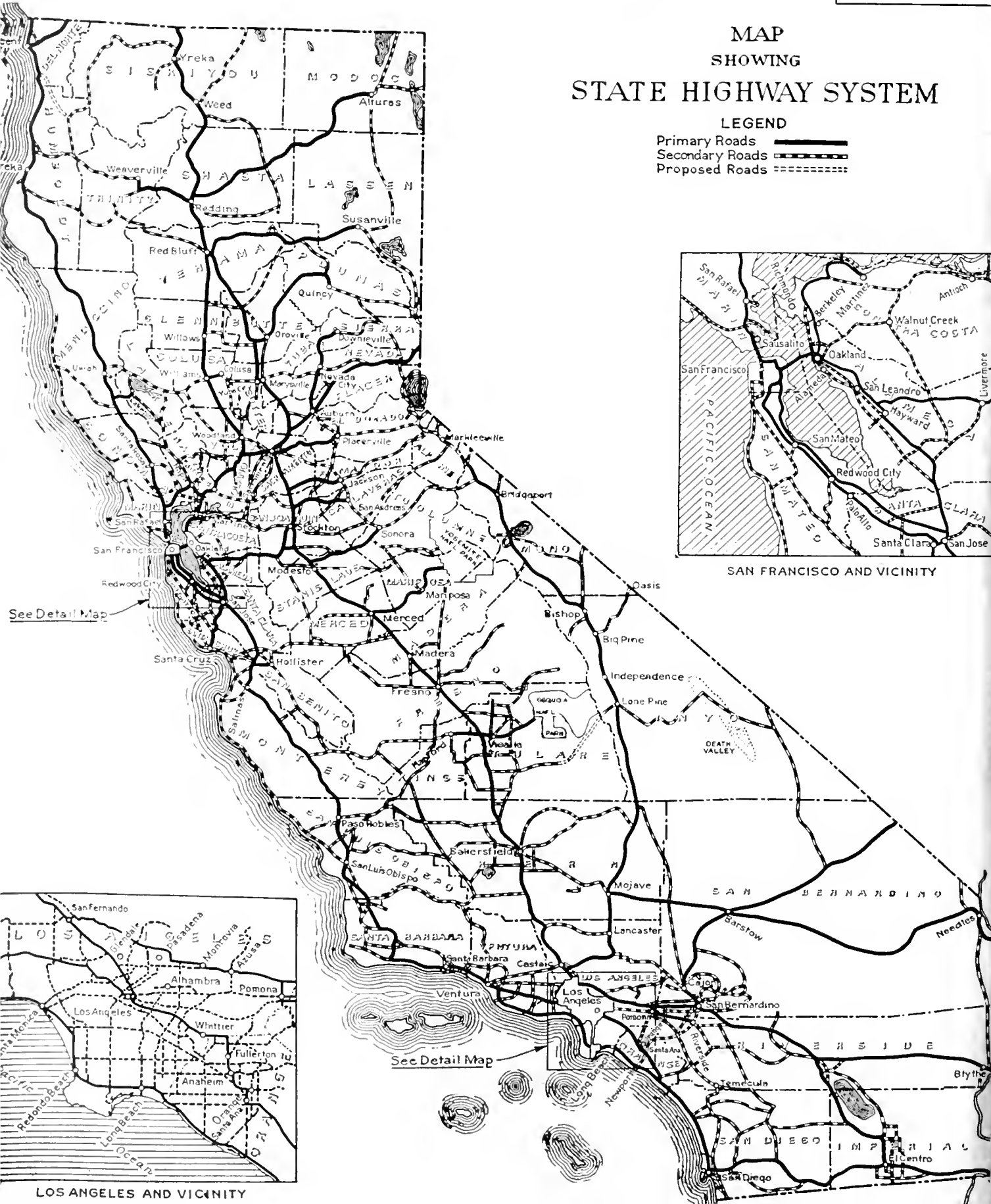
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LEGEND

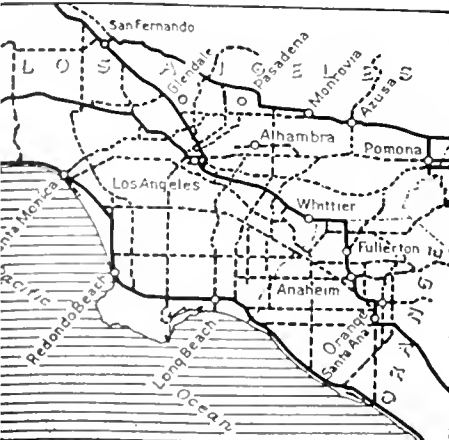
Primary Roads —————
Secondary Roads - - - - -
Proposed Roads = = = = =



SAN FRANCISCO AND VICINITY



See Detail Map



LOS ANGELES AND VICINITY



CALIFORNIA

HIGHWAYS AND PUBLIC WORKS

CARQUINEZ TOLL BRIDGE ACROSS STRAITS OF CARQUINEZ
ON U. S. 40. PURCHASED BY STATE
(SEE ARTICLE IN THIS ISSUE)

SEPTEMBER
1940

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California

FRANK W. CLARK, Director

C. H. PURCELL, State Highway Engineer

J. W. HOWE, Editor

K. C. ADAMS, Associate Editor

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Governor Culbert L. Olson burning the golden chain barrier officially opening Carquinez Bridge under State ownership. Left to right—Governor Olson; Larry Barrett, Chairman California Highway Commission; Edward Murphy, Attorney for California Toll Bridge Authority; Director of Public Works Frank W. Clark; President W. W. Morrish of American Toll-Bridge Co.; L. J. Breuner, Vice President Oakland Chamber of Commerce; Mrs. Audrey Hecht former vice president American Toll-Bridge Co. and Walter Kanen.

State Takes Over Carquinez Bridge; Tolls Reduced Fifty Per Cent

STATE ownership and operation of the Carquinez and Antioch bridges became a reality on September 16th.

Promptly at 11:30 o'clock a.m., Governor Culbert L. Olson, as chairman of the California Toll Bridge Authority, severed with a blow torch the golden chain stretched across the Carquinez bridgehead on the Vallejo side of the Carquinez Straits, and personally purchased the first toll ticket at the new rate of thirty cents per automobile and passengers, thus formally dedicating the structure as a State-owned span.

This momentous ceremony had been preceded by a half hour of speech making, during which Will F. Morrish, retiring president of the American

Toll Bridge Company had presented to Frank W. Clark, Director of Public Works, a deed to the Carquinez and Antioch bridges, which document was in turn handed to the Governor by Mr. Clark.

The celebration at the bridgehead was arranged for by the Oakland Chamber of Commerce with the assistance of chambers of commerce, officials and civic groups of Alameda, Contra Costa, Solano, Sonoma, Napa, Yolo and Sacramento counties. Mrs. Audrey Hecht, widow of Avon J. Hanford, one of the builders of Carquinez Bridge, was introduced and recalled that she had participated in the dedication of the span in 1927. Mrs. Hecht was vice president of the American Toll Bridge Company. Following the dedication ceremonies, a luncheon was tendered to Governor

Olson, State and county officials and distinguished guests at the Casa de Vallejo Hotel in Vallejo.

A large crowd, gathered at the bridgehead, cheered the Governor when he officially took over the bridge for the State of California. Mr. Louis J. Breuner, vice president of the Oakland Chamber of Commerce, acting as chairman of the transfer ceremony committee, after expressing the pleasure of his organization and the East Bay counties over State acquisition of the spans, introduced Mr. Edward Murphy, attorney for the California Toll Bridge Authority, who as master of ceremonies, presented Larry Barrett, chairman of the California Highway Commission. Mr. Barrett said:

"Governor Olson, Director Clark, Mr. Breuner, Mr. Morrish, distinguished guests and friends:

"My pleasure in being here today is twofold. As a member of the California Toll Bridge Authority, I am happy to have been in a position to assist in the acquisition by the State of the Carquinez and Antioch bridges, which we have gathered here today to celebrate. During the period of negotiations for the purchase of these American Toll Bridge Company properties, it has been highly gratifying to Governor Olson and the members of the Authority to know that our plans to place the Carquinez and Antioch spans under public ownership and operation received such widespread support from the public and the press. We all feel that in buying these bridges we have complied with a real public demand.

"As chairman of the California Highway Commission I, together with the other members of the Commission, am very much pleased with the outcome of the negotiations instituted by Governor Olson and Director of Public Works Frank W. Clark which today mark the first steps toward wiping out two toll barriers on the State highway system. We look forward to the time when there will be no toll bridges on our State highways.

"It will require some seven and one-half years to make the Carquinez and Antioch bridges toll-free but, in the meantime, with the reduction of toll charges the motorists of California will benefit by toll savings of more than \$3,000,000. This alone justifies the State's action in purchasing and operating these two bridges.

MORRISH PRESENTS DEEDS

In presenting to Director Clark the deeds to the properties of the American Toll Bridge Company, Mr. Morrish paid a high compliment to the members of the California Toll Bridge Authority and to the Department of Public Works for the business-like manner in which they had conducted negotiations for the purchase of the bridges.

"In retiring as president of the American Toll Bridge Company," Mr. Morrish said, "I want to express to you, Governor Olson, and to you, Director Clark, my wish that in the very near future the tolls on the Carquinez and Antioch bridges can be again reduced and that as speedily as possible the State of California will make these spans toll free."

Accepting the deeds from Mr. Morrish, Director Clark said:

"Needless to say after the part I have played in bringing about State ownership of these bridges, I am highly gratified by the public enthusiasm being expressed here today. Now that the deal has been consummated, I have only a few words to say. There is present here today the man who is entirely responsible for setting in motion the State machinery necessary to

Bidders Express Their Satisfaction

AT THE conclusion of the opening of bids at the meeting of the California Toll Bridge Authority on Wednesday, September 11, 1940, Governor Culbert L. Olson asked the assembled bidders if they were satisfied with the result and the stenographer's record of the incident reads as follows:

GOVERNOR OLSON: And may I ask you if all you bidders feel that the bidding has been conducted fairly, openly and on a true basis of competition, and that the lowest bidder is Kaiser & Company?

A VOICE: No question about it.

A VOICE: No question.

A VOICE: Yes, sir, very much so.

***MR. VIC. E. BREEDON:** Mr. Governor, I would like to state on behalf of one of the associates on the bids, it is very seldom that we have the privilege of having such complete information at the disposal of the bidders prior to the call for bids. I think Mr. Clark and his associates ought to be congratulated on the fine way in which they have presented this issue to the bond buying houses.

* Representative of R. H. Moulton Co. of San Francisco.

make the Carquinez and Antioch bridges publicly owned and publicly operated with tolls cut in half. The man responsible for this achievement is Governor Culbert L. Olson and I take genuine pleasure in presenting him to you."

As Director of Public Works and secretary of the California Toll Bridge

Authority, Mr. Clark delivered to Governor Olson the deed to the bridge. In accepting the deed, Governor Olson said in part:

"My Fellow Citizens:

"It is a most satisfying experience to me as Governor of the State of California to receive this deed transferring the title to the Carquinez and Antioch Bridges to the people. The people have long talked, and hoped for complete public ownership of their public utilities. And, as a matter of fact, for many years it has been the express policy of the State Government to build or acquire, and to own and operate all toll bridges, with the end in view of ultimately eliminating all toll charges.

"Nevertheless, it has been only in the past year and a half that actual official steps have been taken to make the people the owners of these two bridges, which serve an area where more than two million people live and work; people for whom these bridges are a primary public necessity.

"It is true, that by the terms of the franchises held by the private company which, until today, owned these bridges, they would have become public property in 1948. Thereafter they would have become toll-free in only a short while.

SAVING PEOPLE MILLIONS

"But the virtue of taking them at this time rests in the fact that we are now able, with practically no cost to the State, to immediately take them over as publicly owned and operated bridges and at the same time reduce the toll so substantially that in the coming eight years the people using these bridges will save millions of dollars; in fact, almost as much as is being paid for the bridges out of their revenues during that period.

"There are two reasons for these great savings.

"First, the State does not have to exact a profit over and above the cost of operating the bridges and retiring the revenue bonds issued for their purchase.

"And second, the California Toll Bridge Authority, acting for the people, has obtained this purchase money at an interest rate of only about one and three-quarters per cent. This extraordinary low interest rate indicates not only that the bond purchasers have ample security



Carquinez Toll Bridge across the Straits of Carquinez on U. S. 40 (State Highway Route 7) purchased by the State.



Antioch Toll Bridge across the San Joaquin River on State Highway Route 11 near Antioch, purchased by the State.



Director Frank W. Clark presenting Governor Olson the deed to the bridges.

and are anxious to support their government by financing sound public enterprises, but it also indicates that they recognize revenue bonds as sound investments.

TOLLS PAY FOR BONDS

"These bonds are not an obligation against the people, nor against the State Government, nor even against the bridges themselves. They are payable only out of the bridge revenues; out of the tolls paid by the people who use them at almost one-half the previous toll charges to cross these mighty rivers.

"I take this opportunity to voice public recognition and praise of the many people whose hopes and prayers, whose agitations and ardent labors, consummated the happy ending that we here celebrate. To them are due the fervent thanks of the millions of people who use these bridges.

"First it seems to me that special recognition is due to Mr. Frank W. Clark, the State Director of Public Works, and his attorneys and staff for so ably conducting the investigations and delicate negotiations which led to this auspicious occasion. It was their work that enabled the purchase at a most reasonable price, and the

sale of the revenue bonds on such favorable terms.

TRIBUTE DUE SPONSORS

"Grateful tribute and recognition are due to the boards of supervisors and the many city councils in the areas tributary to these bridges; and to the Chambers of Commerce, the California State Grange, and the Labor Unions, and the civic, fraternal, and patriotic organizations and to the hundreds of individual citizens whose persistent agitations created the public sentiment so necessary to the successful consummation of this large public ownership enterprise.

"Recognition and thanks are due to the many investment underwriters whose careful appraisal of this enterprise led them to compete so vigorously for the privilege of financing it on terms so favorable to the people.

"There are, it is true, a very few citizens who will condemn this transaction as a piece of socialism; as government encroaching upon private enterprise; "government in business."

"But the rest of us will recognize it for exactly what it is; a very practical piece of business; a highly successful example of the virtue and benefits of public ownership. It mat-

ters little what we call it. It serves the principle pronounced many years ago by Abraham Lincoln that government should do for the people the things they can not do for themselves, or the things which they can not do so well for themselves.

"From today on every citizen who pays toll here can do so with that satisfying sense of the pride and freedom that attend ownership; thoughtful of the day, only a few years from now, when he may use this bridge free of charge. Thus this bridge stands as a lasting symbol of things American. Soon we shall strike this bridge free from the tolls and charges that narrow and restrict its use.

"By the same token we may now look forward to the day when we in America shall strike ourselves free from the bigotries and prejudices which narrow and restrict our realization of the full benefits implicit in the promise of American Life.

"I am immeasurably grateful for the small part it has been my proud privilege to play in bringing about this happy and successful conclusion. "I thank you."

LUNCHEON FOLLOWED CEREMONIES

Some two hundred civic leaders and officials attended the luncheon given by the Vallejo Chamber of Commerce and the Vallejo Junior Chamber of Commerce following the bridgehead ceremonies. Luther Gibson, Vallejo publisher, presided at the luncheon and introduced for brief addresses Mr. Murphy, Mr. Bremner, Mr. Barrett, Mr. Morrish and Director Clark.

Governor Olson closed the day's celebration with an address in which he pointed out that such community spirit and cooperation as was evidenced at the bridgehead and at the luncheon was highly encouraging for all those who believe that public ownership is greatly desirable when private property is not confiscated and the greatest public good possible is achieved.

In a statement reviewing the negotiations leading up to State acquisition of the bridges, Director of Public Works Clark said:

"On September 11th, bids for revenue bonds necessary to finance the acquisition of these structures were opened by the California Toll Bridge Authority with the astonishing result that the State received from Kaiser & Co. and Sargent, Taylor & Co. of San Francisco a bid providing for a premium amounting to \$500,999.99, which assures an almost unbelievably

low rate of interest approximating one and three-quarters per cent and makes practically certain that the bridges will become toll-free six months earlier than had been anticipated.

"Acquisition of these toll spans is an outstanding example of Governor Culbert L. Olson's public ownership policies. In purchasing the bridges, the State has made possible great public benefits without injury to private interests or confiscation of private property.

"The soundness of the deal, which was negotiated by the present administration under the personal direction of Governor Olson, is evidenced by the wide interest in the Carquinez Toll Bridge Revenue Bonds manifested by investment dealers in all parts of the United States.

"If our present revenue estimates for the spans work out, tolls can be discontinued late in 1947 and all bonds paid off not later than January 1, 1948.

"As a result of the competition engendered, the State received a bid from Kaiser & Co., and Sargent, Taylor & Co., pursuant to which the California Toll Bridge Authority was only required to issue \$5,943,000 principal amount of bonds, and received, in cash, \$6,443,999.99 plus accrued interest. In addition, as a part of the purchase price of the bridges, the State received \$350,000 cash now held by the American Toll Bridge Company, resulting in a net cost of the two bridges of only \$5,593,000.

"The method of sale adopted by the Bridge Authority, while comparatively new in California, is a well-established practice in the East of selling the least number of bonds which will produce a given sum of money. As a result of adopting this method of financing, the State was able to immediately cut tolls on the Carquinez and Antioch bridges in half, and will also be able to pay off and retire all of the \$5,943,000 bonds to be actually issued by 1947, or more than six months before the date of the expiration of the present franchise. Upon retirement of the bonds the bridges become toll free. In addition to making both bridges toll free prior to the time they would revert to the State under the present law, the motoring public will save an amount estimated to be in excess of three million dollars as a result of the reduced tolls.

"Acquisition of the bridges by the State does not, in fact, involve the State in any obligation, as the bonds to be issued will be paid entirely from revenues from the Carquinez and Antioch bridges, and no taxes of any kind or character can legally be levied for their payment.

"Negotiations for the purchase by the State of the Carquinez and Antioch bridges came to a head on August 23rd when the California Toll Bridge Authority, of which Governor Olson is chairman, meeting in San Francisco, approved the terms of a revised offer for the properties which had been made by the Department of Public Works to the American Toll Bridge Company and accepted by that corporation.

"At the same time, the Authority authorized the issuance and sale of one to fifteen-year serial bonds in the amount of \$6,443,000.

"The Authority also appointed the Pacific National Bank of San Francisco, fiscal agent, and designated the Manufacturers Trust Company of New York City, N. Y., collection agent under the bond issue.

"The State Railroad Commission approved of the purchases of the bridges on September 3.

"Under an agreement between the contracting parties, the Toll Bridge Company credited to the State cumulative toll collections at the rate of \$2,200 a day from March 1, 1940, to the closing date of negotiations, September 16, or \$437,800 for a total of 199 days.

"Had this stipulation not been insisted upon, the State would have been deprived of \$437,800 and the bond issue would have had to be increased accordingly.

"The purchase price approved by the Toll Bridge Authority on August 23rd and which supplements the original one accepted by the owners of the bridges on May 21st last, offers a definite solution of the problem of the Martinez-Benicia Ferry, owned and operated by the American Toll Bridge Company.

"The new agreement provides that the Toll Bridge Company at the request of the Department of Public Works, will: (Continued on next page)



Governor Olson buys first bridge ticket at new price of thirty cents.



President Morrish of American Toll-Bridge Company gives bridge deed to Director Clark.

"(a) Without the payment of any additional compensation cause the operative properties and franchises now owned by the Martinez-Benicia Ferry to be transferred and conveyed to the counties of Contra Costa and Solano, or either of them, the cities of Martinez and Benicia, or either of them, or to any other person, firm or corporation, group or association designated by the Department of Public Works, subject to approval by the State Railroad Commission, or

"(b) Apply to the Railroad Commission for permission to abandon the Martinez-Benicia Ferry and, to the best of its ability, divest the ferry company of all right to own, operate or maintain its ferries or franchise rights appertaining to the operation thereof, upon the condition that the Department of Public Works will make such request within not more than thirty days from the closing date of negotiations with the American Toll Bridge Company; otherwise the Company shall be free to take such action as it deems advisable with respect to the ferry."

List of Bidders for Carquinez Toll Bridge Revenue Bonds

	Purchase price offered	Par value of bonds to be taken for purchase price
Kaiser & Co., Sargent, Taylor & Co.	\$6,443,999.99	\$5,943,000.00
Harris Hall & Co. and Associates	6,443,999.99	6,027,000.00
Blyth & Co. and Associates	6,443,999.99	6,050,000.00
First Boston Corporation and Associates	6,443,376.00	6,115,000.00
Lehman Bros. and Associates	6,443,680.14	6,194,000.00

"On behalf of Governor Olson and the California Toll Bridge Authority, I desire to assure the residents of Contra Costa and Solano counties, particularly the citizens of Benicia and Martinez who now use the Martinez-Benicia ferry, that the State will make every effort to keep the ferry in operation. The ferry either will be turned over to one or more of the political subdivisions interested or some arrangement will be made whereby the present employees of the ferry, if they are able to organize a cooperative association to operate this service, will be permitted to continue operation.

"I have discussed this matter with the Railroad Commission and the Department of Public Works has given extensive consideration to plans for future operation of the ferry.

"The offer made by the State for the bridges was predicated upon the assumption that the company had no actual physical properties for sale inasmuch as title to the two spans would revert to Contra Costa and Solano counties, in which they are located, in approximately

eight years. The company held a franchise giving it the right to operate the bridges and collect tolls until the expiration of the franchise in 1948. The State's offer was based on the earnings which could have been realized during the remaining eight years of operation.

"In recommending to the Toll Bridge Authority the purchase of the bridges, the Department

(Continued on page 26)



CARQUINEZ BRIDGE

OWNED & OPERATED

BY

STATE OF CALIFORNIA

PASSENGER AUTOMOBILE TOLL

REDUCED TO 30¢



Sign announcing State-owned bridge and reduced toll price.

Traffic on State Highways Shows Increase of 2.2 Per Cent Over 1939

By C. H. PURCELL, State Highway Engineer

IN ACCORDANCE with long-established practice the annual state-wide traffic count on State highways was taken Sunday and Monday, July 14 and 15. A comparison with the same period for 1939 shows an increase of slightly more than 2 per cent.

While seemingly a very moderate increase, it is in reality a very sizable one when we recall that the July 1939 figures, which it exceeds, were very much above the average for the first half year of 1939 taken as a whole, as was pointed out at that time.

No such sudden spurt has been recorded during July of the present year, but a very pronounced increase in traffic on the State Highway System for the full seven months' period is indicated by the monthly counts recorded at regularly established key stations. This increase is approximately 7 per cent, which compares rather closely with the increase in excess of 5 per cent noted in gasoline sales for the State as a whole.

There were few routes showing either spectacular gains or losses. Neither was there any great variance between the increase shown for traffic on Sunday as compared with that for Monday. Comparison of the main groups shows "Recreational" routes as enjoying the largest increase, with the "Main North and South" group continuing to carry approximately the same heavy volume of traffic as that recorded in July, 1939.

There was no change from the regular procedure of previous years in the manner of taking the count. Actual recording covers the 16-hour period from 6 a.m. to 10 p.m. for both Sunday and Monday. Traffic was segregated by hourly periods into the following vehicle classifications: California passenger cars, out-of-state passenger cars, buses, light trucks, heavy trucks, trailers drawn by trucks, trailer coaches, and other passenger-car trailers.

Each year some minor changes in the census become necessary, such as the relocation, addition, or discontinuance of individual stations.

These comparisons for the various route groups are as follows:

PER CENT GAIN OR LOSS FOR 1940 COUNT AS COMPARED WITH 1939		
	Sunday	Monday
All Routes	+ 2.49	+ 2.13
Main North and South Routes	— .40	+ .25
Interstate Connections	+ 4.09	+ 3.93
Laterals Between Inland and Coast	+ 3.82	+ 3.84
Recreational Routes	+ 8.06	+ 4.91

The gain or loss of traffic volume for State Highway Routes 1 to 80, inclusive, which constitute the basis for the foregoing summary, is shown in the following tabulation:

Route	Termini	1940 Per cent gain or loss			
		Sunday		Monday	
		Gain	Loss	Gain	Loss
35. Rt. 1 at Alton-Rt. 20 at Douglas City					
37. Auburn-Truckee		6.81		6.26	5.96
38. Rt. 11 at Mays-Nevada Line via Truckee River				1.83	3.92
39. Rt. 38 at Tahoe City-Nevada State Line		12.30			2.39
40. Rt. 13 near Montezuma-Rt. 76 at Benton			13.55		14.46
41. Rt. 5 near Tracy-Kings River Canyon via Fresno		12.61			13.52
42. Redwood Park-Los Gatos			0.18		0.57
43. Rt. 60 at Newport Beach-Rt. 31 near Victorville		7.37			1.53
44. Boulder Creek-Redwood Park		1.41			4.70
45. Rt. 7, Willows-Rt. 3 near Biggs			17.65		11.37
46. Rt. 1 near Klamath-Rt. 3 near Cray			9.70		6.43
47. Rt. 7, Orland-Rt. 29 near Morgan			1.76		2.02
48. Rt. 1 N. of Cloverdale-Rt. 56 near Albion			6.49		22.98
49. Napa-Rt. 15 near Sweet Hollow Summit		10.35			8.75
50. Sacramento-Rt. 15 near Wilbur Springs			2.44		1.34
51. Rt. 8 at Schellville-Sebastopol			2.42		9.83
52. Alto-Tiburon			2.89		11.99
53. Rt. 7 at Fairfield-Rt. 4 at Lodi via Rio Vista		5.57			7.21
54. Rt. 11 at Perkins-Rt. 65 at Central House		3.49			13.36
55. Rt. 5 near Glenwood-San Francisco			15.98		14.25
56. Rt. 2 at Las Cruces-Rt. 1 near Fernbridge			6.43		1.49
57. Rt. 2 near Santa Maria-Rt. 23 near Freeman via Bakersfield			3.47		7.07
58. Rt. 2 near Santa Margarita-Arizona Line near Topock via Mohave and Barslow		7.27			1.72
59. Rt. 4 at Gorman-Rt. 43 at Lake Arrowhead		7.59			1.34
60. Rt. 2 at Serra-Rt. 2 at El Rio		16.97			7.64
61. Rt. 4 S. of Glendale-Rt. 59 near Phelan		25.59			12.19
62. Rt. 171 at Northam-Rt. 61 near Crystal Lake		6.30			6.56
63. Big Pine-Nevada State Line		68.25			85.57
64. Rt. 2 at San Juan Capistrano-Blythe		7.64			8.80
65. Rt. 18 near Mariposa-Auburn		9.73			1.07
66. Rt. 5 near Mossdale-Rt. 13 near Oakdale		11.36			1.39
67. Pajaro River-Rt. 2 near San Benito River Bridge		1.75			9.80
68. San Jose-San Francisco		4.34			8.25
69. Rt. 1 at Warm Springs-Rt. 5 San Rafael		0.90			3.28
70. Ukiah-Talmage		39.33			23.32
71. Crescent City-Oregon Line		8.74			4.72
72. Weed-Oregon Line		7.40			9.59
73. Rt. 29 near Johnstonville-Oregon Line		11.53			12.50
74. Napa-Wye-Cordelia via Vallejo and Benicia		21.77			20.41
75. Oakland-Jc. Rt. 65 at Altaville			2.58		12.25
76. Rt. 125 at Shaw Ave.-Nevada State Line near Benton		40.18			14.24
77. San Diego-Los Angeles via Pomona			3.36		4.96
78. Rt. 12 near Descanso-Rt. 19 near March Field			4.96		0.41
79. Rt. 2, Ventura-Rt. 4 at Castaic		12.73			3.97
80. Rt. 51, Rincon Creek-Rt. 2 near Zaca		7.00			5.79

Los Gatos-Santa Cruz Highway Unit Dedicated and Opened

WITH a colorful program of pageantry, ceremony and music the last 1.8 miles of the Los Gatos-Santa Cruz highway relocation and reconstruction project was dedicated and officially opened on August 30th at Los Gatos in the presence of State, county and city officials and civic dignitaries.

The opening of this final unit of a modern highway between the Santa Clara Valley city and Santa Cruz on Monterey Bay marks the completion of a Division of Highways project that has progressed by stage construction under six separate contracts over a period of 9 years and 6 months and has cost the State approximately \$3,000,000. It is 20.6 miles in length of which 14.6 miles is four-lane road and the rest 3-lane.

The dedicatory ceremonies featured a parade of old and modern modes of transportation after the cutting of a ribbon raised a barrier and was followed by addresses of officials introduced by President Stanley Mills of the Los Gatos Chamber of Commerce.

REPRESENTS GOVERNOR OLSON

The two principal speakers were Colonel John H. Skeggs, District Engineer of the State Division of Highways in charge of the project, representing State Highway Engineer C. H. Purcell and Deputy District Director of Public Works Morgan Keaton, who represented Governor Olson and Director of Public Works Frank W. Clark. Mr. Keaton said:

"It is a real pleasure for me to be here today as your guest and I bring you the very sincere greetings of your Governor, Culbert L. Olson, and convey to you his regrets that he can not be here in person. I bring you also the best wishes and heartiest greetings of your Director of Public Works, Mr. Frank W. Clark, who sincerely regrets he is also unable to be with you on this memorable occasion.

"The opening of this 1.8-mile section of State highway marks the completion to modern engineering standards of the twenty miles between Los Gatos and Santa Cruz.



MORGAN KEATON, Deputy Director of Public Works

"The State of California has for the past several years been confronted with the difficult task of providing steady improvement to 14,000 miles of road in the State Highway System with no increase in the rates of State gasoline tax and motor vehicle fees since the State Highway System was less than one-half the present mileage.

HIGHER STANDARDS DEMANDED

"In addition to this doubling of mileage without increase in basic rates for State revenue, the State is confronted with an increasing volume of traffic which necessitates and demands even higher standards of safety and convenience in construction of highway facilities.

"To meet these demands for improvement to greater mileage and higher standards has required the most careful planning on the part of Division of Highway Engineers and critical selection by the California

Highway Commission of projects proposed for inclusion in biennial highway budgets.

"The increasing popularity with motorists of the redwood covered Santa Cruz mountains and of the beautiful beaches along the northern shore of Monterey Bay resulted in traffic volumes on the Los Gatos-Santa Cruz route beyond the service ability of the old highway.

FIRST CONTRACT IN 1931

"In planning orderly development of the highway system throughout the State, modernization of this scenic route has held a prominent place. Almost ten years ago reconnaissance surveys were complete for the relocation of this highway between the Santa Clara Valley and the coastal country at Santa Cruz.

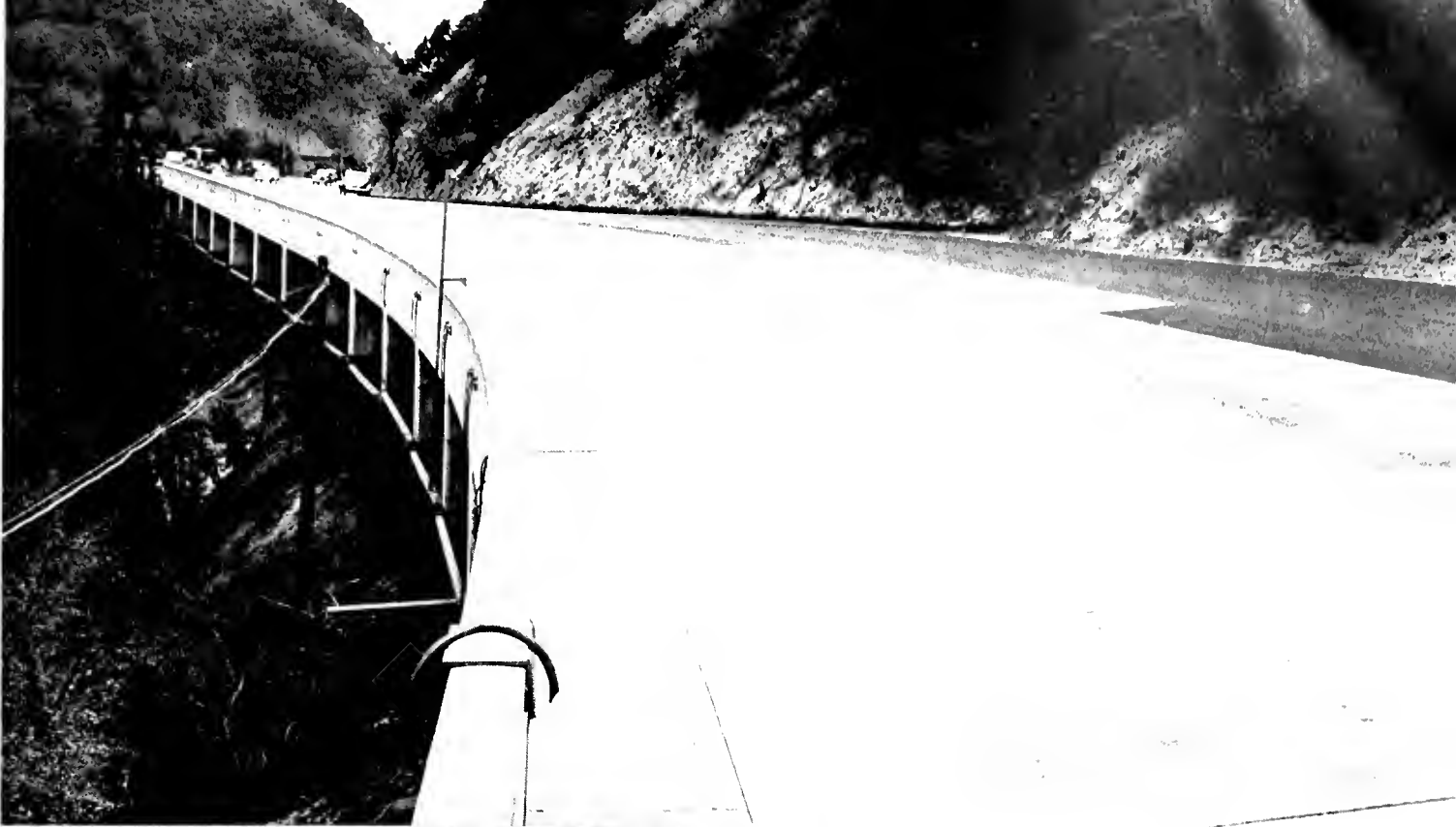
"As rapidly as available funds could be allocated by the commission a series of major contracts have been under way for construction of adequate highway facilities through this section of the coast range.

"On May 18, 1931, the Department of Public Works awarded the first of the contracts providing for grading and surfacing of the State highway from the city limits of Santa Cruz to a point one mile northerly. Three contracts were then awarded between 1933 and 1934 for construction on improved line and grade between Inspiration Point and Scotts Valley and, in 1936, the gap between Scotts Valley and one mile north of Santa Cruz.

LARGEST GRADING CONTRACT

"In December of 1937 the largest of the contracts was awarded for construction of the route between The Oaks and Inspiration Point. On June 30 of last year many of you were present at the dedication when Mr. Frank W. Clark, Director of Public Works, officially opened that section.

"In passing, it might be well to comment that the construction of that six and one-half miles was one of the largest highway grading contracts ever undertaken by the Division of Highways. Over 2,500,000 cubic



Two views of sidehill viaduct on Los Gatos-Santa Cruz 4-lane highway. Top picture shows how two lanes are carried on viaduct built on curve. Bottom picture shows steel piling and character of construction supporting the highway.

yards of earth were moved in the construction of the roadway and structures. The foundation treatments in construction of the massive fills and deep cuts were developments of detailed engineering studies and the project received much comment and study in highway engineering circles throughout the entire country. The Los Gatos-Santa Cruz highway is one of the nationally known highways.

"On the thirteenth of December last year the Director of Public Works, Frank W. Clark, awarded the last of the road construction contracts—the one we open to public travel today. One month later, January 11 of this year, the last structure contract was awarded for construction of the side hill viaduct one-half mile south of Los Gatos.

SIDE-HILL VIADUCT SOLUTION

"Construction of this last section, the 1.8 miles between Oaks Road and Los Gatos, has not been a simple task.

Exhaustive engineering investigations were necessary to locate the four-lane highway in the narrow Los Gatos Creek Canyon, where the railroad and water company both had existing facilities. These studies emphasized the necessity of avoiding as far as possible heavy cuts in the hillside. The results of these engineering and geophysical investigations concluded with inclusion in the road design the side-hill viaduct.

"The entire reconstruction program for the State highway between Los Gatos and Santa Cruz has involved eleven contracts and the total cost to the State will exceed two and one-half million dollars.

"The new highway makes the distance between the Santa Clara Valley and Santa Cruz only 20.6 miles, a saving of approximately five miles over the distance traversed by the old road. In reconstruction, the new highway has eliminated innumerable sharp curves and steep pitches in grade line.

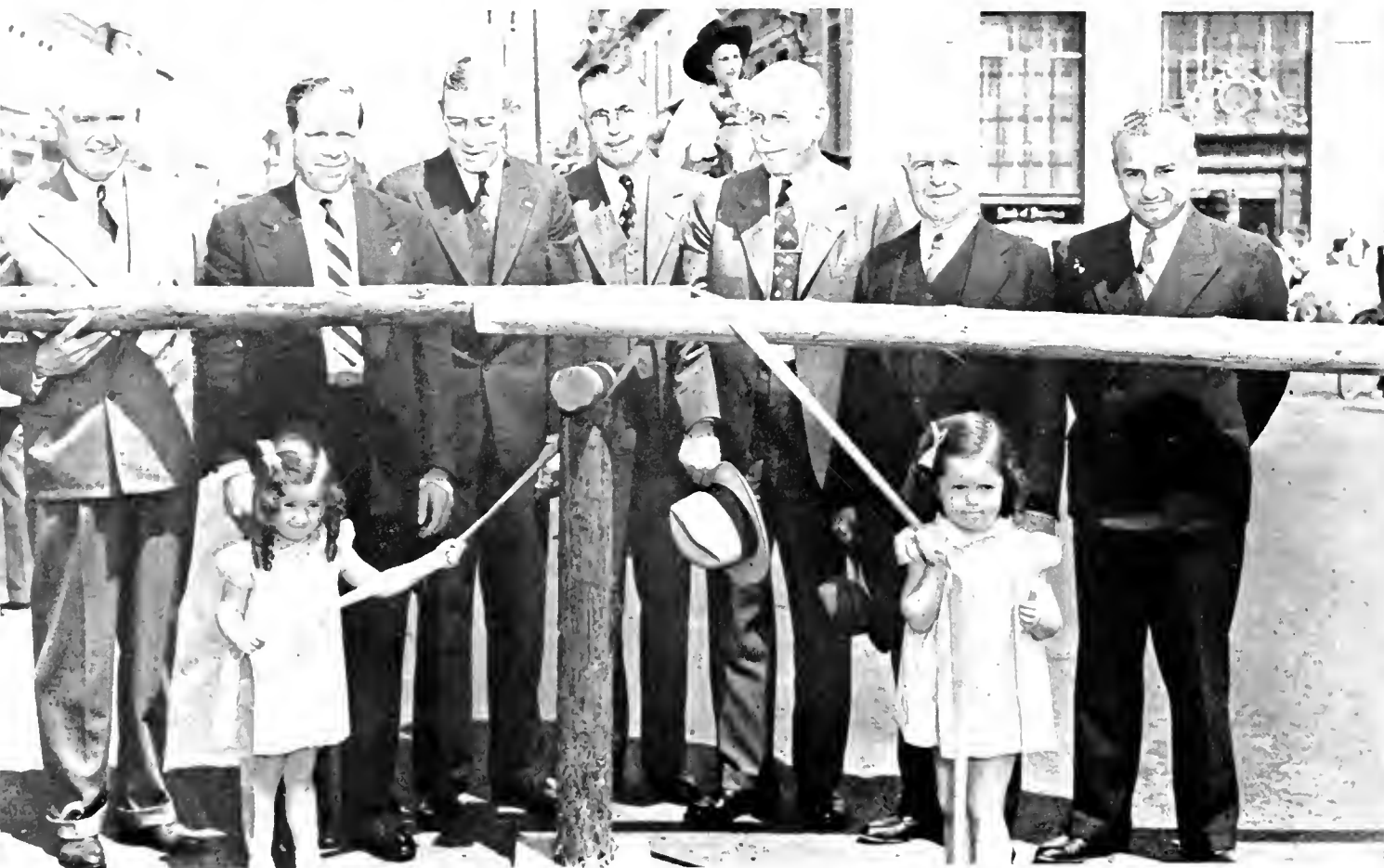
"The present highway presents to the motorist an urban boulevard through the mountains. Over 14½ miles of four-lane road and about 6 miles of three-lane.

"The days of congested traffic crawling in long lines behind some slow-moving vehicle have left the Santa Cruz road and the Department of Public Works today presents to the people of California a completed thoroughfare through one of this State's most scenic sections."

Colonel Skeggs, in his brief talk, thanked the people of Los Gatos and Santa Cruz and intervening points for enduring without criticism the inconveniences to which they were subjected during the period of construction.

"I don't think we have ever had a more difficult job to execute," he said, "and we of the highway department want to thank the people of Los Gatos for their cooperation during the construction of this last section."

The last link, Col. Skeggs said,



Official group at highway dedication. Left to right—President Stanley Mills, Los Gatos Chamber of Commerce; Morgan Keaton, Deputy Director of Public Works; Jno. H. Skeggs, District Engineer; G. A. Morgan, Chairman, Santa Cruz County Supervisors; Supervisor C. P. Cooley, of Santa Clara; C. D. Hinkle, Mayor of Santa Cruz, and Marc Vertin, Member of City Council and Acting Mayor of Los Gatos. The little girls are Nadyne Rhinelander and Cecelia Miller of Los Gatos.



View of wide, sweeping curves on newly completed unit of 4-lane Los Gatos-Santa Cruz Highway before traffic lines were painted.

cost \$300,000 per mile and the engineering problem consisted of squeezing a highway in between the slopes of a steep hill and a railroad right-of-way at the base of it making it necessary to carry two of the lanes on a side-hill viaduct. The contractors were Heafey-Moore Co. and Fredrick-Watson Construction Company.

The Los Gatos and Santa Cruz Chambers of Commerce cooperated in the celebration arrangements and entertainment of officials and guests at a luncheon after the ceremony. Among those who participated in the dedication were: Vice Chairman Bert B. Snyder, president of the Santa Cruz Chamber of Commerce; Supervisor C. P. Cooley of Santa Clara County, Supervisor George Morgan of Santa Cruz County, Mayor C. D. Hinkle of Santa Cruz, Acting Mayor Marc Vertin of Los Gatos; Santa Clara County Surveyor Robert Chandler; M. C. Hall, Santa Cruz Chamber of Commerce manager; Andy Balich and Lloyd Bauman, members of the Santa Cruz Chamber of Commerce highway committee, and others.

A treasured possession of the Los Gatos Chamber exhibited by Manager



W. W. Clark is a stock certificate dated San Jose May 20th, 1863, for 66 shares in the Santa Cruz Gap Turnpike Joint Stock Company incorporated in 1857 with a capital stock of \$21,000 to build a turnpike road over the mountains.

Mom: "Where is Jimmy this afternoon?"
 Pop: "If he knows as much about canoes as he thinks he does, he is out canoeing. But if he doesn't know any more about it than I think he does, he's swimming."

T. H. DENNIS, RESEARCH CHAIRMAN

T. H. Dennis, Maintenance Engineer of the California Division of Highways, has been appointed by the Highway Research Board of the National Research Council as chairman of a committee to prepare a paper on maintenance equipment.

Other members of the committee are: H. K. Bishop, of the Public Roads Administration; J. E. Lawrence, Massachusetts Department of Public Roads; Rex M. Whitton, Missouri State Highway Department; A. A. Anderson, Portland Cement Association; B. E. Gray, The Asphalt Institute.



General view of oval track for testing highway construction material and surface mixtures to destruction under heavy truck traffic.

Road Construction Test Track Built

By T. E. STANTON, Materials and Research Engineer

IN AN effort to develop exact data from which to more intelligently and economically design low cost road construction with consequent material saving in cost either of original construction or subsequent maintenance, a test track has recently been built in the vicinity of Sacramento and is now being tested to destruction under heavy truck traffic.

This test track is of sufficient width to permit the operation of loaded trucks. It is oval in shape with the test installations on the tangents between the curved ends. In other words, the test track consists of two parallel straight test sections about 200 feet apart connected at the ends by semicircular arcs. Each straight-away is 200 feet long and is divided laterally and longitudinally into four test panels, each $7\frac{1}{2}$ feet wide and 100 feet long; a total of eight test sections of different types of construction.

Construction consisted of excavating a trench section to a level grade

and cross-section which was then filled to a depth of 6 inches with clean porous sand and screenings. Over this sand cushion a 12-inch blanket of imported soil of low bearing value was placed. A soil was selected which developed a minimum saturated bearing value of 5 per cent or less. This adverse soil subgrade was carefully placed and compacted as uniformly as possible at a suitable moisture content.

In order to secure absolute uniformity both in gradation of aggregates and in the amount of binding material the various types of materials included in the test were accurately proportioned and mixed in a pug mill at a contractor's mixing plant.

It was considered important that the granulometric composition of comparable treated and untreated types be as nearly alike as possible. It was also desirable that no variations other than design variations occur throughout the depth or length of any particular panel.

After being prepared in a central mixing plant the mixtures were hauled to the track and placed on the compacted subgrade to a level cross-section, but to a variable thickness longitudinally. The purpose of this type of construction was to provide a thickness of base at one end of each test section which must inevitably fail and at the other end of sufficient thickness to stand up under heavy truck traffic when the subgrade soil is saturated.

The thickness of the base was increased uniformly longitudinally from a thickness of approximately three inches at one end to a depth of 18 inches at the farther end, which latter depth is believed to be more than sufficient to prevent failure of all types tested. Failure of each type of base should then progress from the thinner end back to a point representing the minimum thickness under which the type will withstand a given amount of traffic.

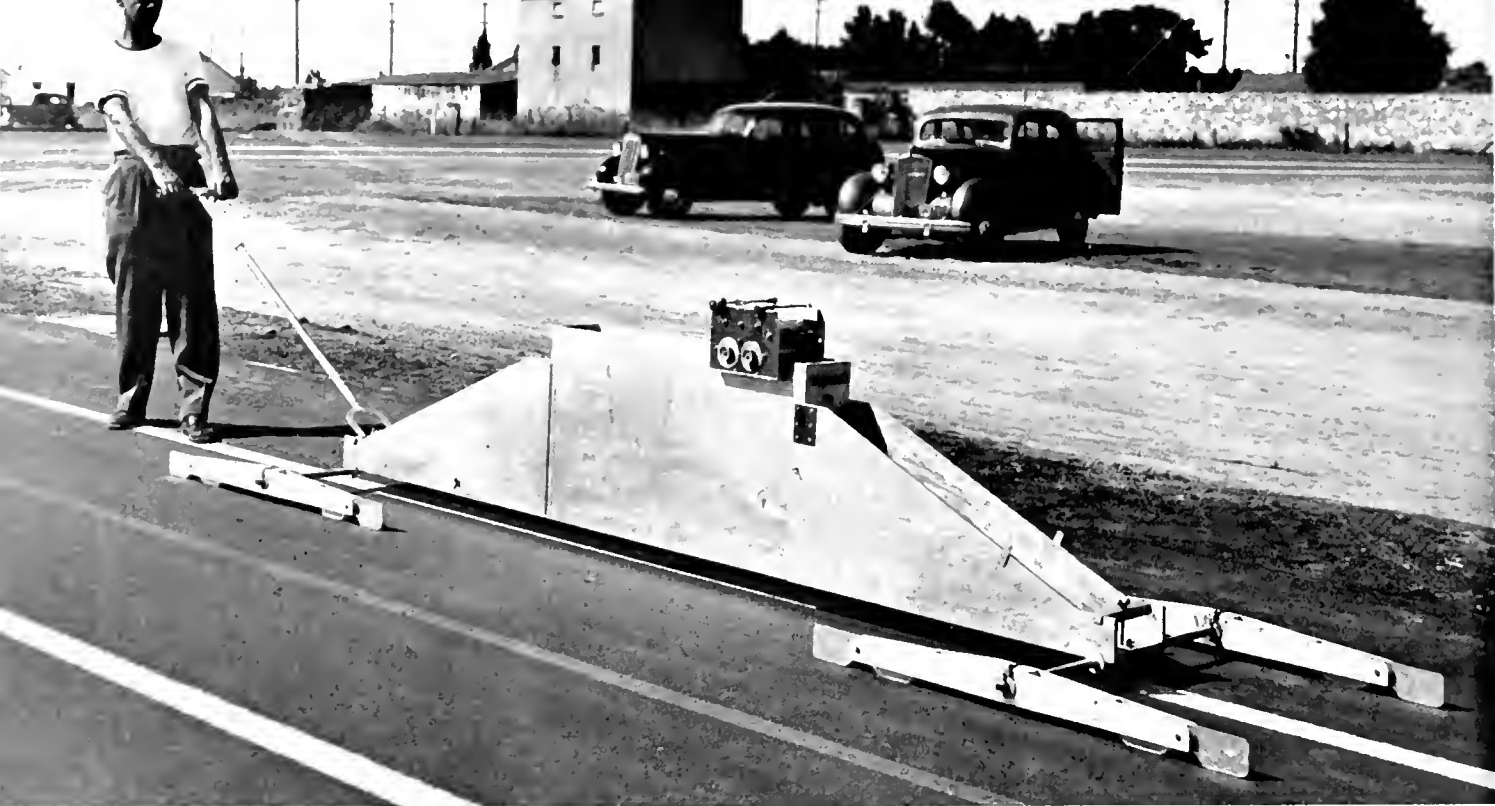


Above—Test track straightaway with 8 test sections of treated material. Below—Superelevated curve surfaced with bituminous mixtures.

Theoretically, the point of maximum thickness at which failures occur will serve as a direct comparison of

the relative merits of the various types. It should thus be possible to determine by direct observation

whether or not any benefit is derived from any particular stabilization treatment, and if such benefit is com-



Roughometer designed and built at the Division of Highways laboratory for measuring roughness of pavement surfaces.

mensurate with the cost involved.

As stated, the construction layout permits the testing of eight separate panels under comparable test conditions; the types proposed being as follows:

- (1) Crusher run base (untreated) with a minimum bearing value of 100%
- (2) Cemented gravel mixture (untreated) with a 50% bearing value
- (3) Same as (2) stabilized with emulsified asphalt
- (4) Same as (2) stabilized with Portland cement
- (5) Sand clay mixture (untreated) with a 15% bearing value
- (6) Same as (5) stabilized with emulsified asphalt
- (7) Same as (5) stabilized with Portland cement
- (8) Same as (5) stabilized with cutback asphalt (special)

A plant mixed surfacing two inches thick was placed over the base section, thus making a total thickness of base and surface ranging from five inches to twenty inches.

The subgrade, base, and bituminous wearing surface of each section were compacted to the extent usually obtained under favorable construction conditions. After all materials were in place and compacted, a number of

trips were made with a loaded truck to determine if the base and surfacing were inherently stable when dry and supported by a solid foundation.

At the appropriate time the sand bed was flooded with water to saturate the low bearing soil subgrade. After the moisture content of the subgrade reached a predetermined value, actual testing of the road was begun, using one or more loaded trucks to test the various sections to destruction.

Each failure is being repaired as it develops after noting the position and character of the failed area. The surface is constantly maintained in good condition during the test in order that no sound area may be prejudiced by failure of an adjacent weaker section.

The traffic part of the test was started during the first week in September, therefore, no information of value is as yet available. It will probably require a number of weeks of concentrated truck traffic to produce reliable results on which future designs can be based.

The construction and tests described above afford the opportunity for a number of collateral tests not directly related to the subject of foundation treatment but which it is hoped will furnish the answer to several other perplexing problems.

For instance, the traffic department

is interested in securing exact data on the relative efficiency of several simple types of automatic traffic recording devices. A controlled and definite volume and weight of traffic such as that on the test track affords the opportunity to secure this information.

In a similar way, tests are to be made of the load carrying capacity and resistance to abrasion of low cost bituminous surface mixtures using four grades of liquid asphaltic binders. The surfacings have been placed with and without bituminous seal or binder coats on the subgrade to determine the advantage, if any, of binder coats.

Pressure, deflection and temperature measuring devices have been installed and tests are being made of the distribution of pressure at different depths; deflections of the surface on dry and saturated foundations and the temperature at various depths below the surface.

Different formulation traffic lacquers will be tried out on the traffic guide lines to ascertain if any improvement or economy can be effected in our standard California type traffic lacquer.

Roughness measurements will be made with a new light weight portable type roughometer designed and built at the Laboratory. These measure-

(Continued on page 23)

State Institutional Building Picture Facing Division of Architecture

By ANSON BOYD, State Architect

THE State's mental hospitals had 19,437 inmates, on June 30, 1935. Five years later this number has risen to 23,000. The State Fire Marshal has surveyed the State institutions and has raised serious doubts about the safety of a large number of overcrowded and antiquated State hospital structures. These two bald facts form the background for any consideration of a State institutional building program.

Recently and in line with a cooperative study of the State institutional requirements, Director Frank W. Clark, of the Department of Public Works, has suggested that its Division of Architecture discontinue this institutional building program.

Before drawing any conclusions from a rising curve of State and institutional population or the adequacy and safety of the present buildings and equipment, it is appropriate to state our understanding of the basic aims of the Department of Institutions and the legal restrictions upon the type of buildings erected.

As to the first, the State has for many decades assumed, for reasons generally of public welfare, the segregation and permanent care of mentally afflicted people and has viewed the steadily increasing load as a necessary function to be accepted and provided for. Under the more recent scientific approach to this problem, early treatment and preventive measures have been instituted and under the present administration applied intensively.

BUILDING PLANS AFFECTED

This latter policy vitally affects the contents of an institutional building both as to plan and equipment. Secondly, the existing laws define minimum safety requirements which apply to any structure in which persons are held under restraint against their will. This requirement sets a cost floor which eliminates very cheap, nonfire resistant types of construction and in general terms defines the ma-

terials of which institutional buildings must be built. Thus we are compelled to begin with two contrasting and contradictory factors to be compromised in working out with the Department of Institutions a solution to their long term plan and immediate detail needs.

On the one hand is a constructive and scientific handling of otherwise potential long-term patients by means of treatment, readjustment, and care in order that they may be returned in as large numbers as possible to their normal places in their communities, thus counteracting to some extent the steady increase; and on the other hand, is the condition of overcrowding and hazardous housing of permanent patients which teeters perilously on the edge of disaster, which makes bare space for more beds imperative.

BUILDINGS DETERIORATED

While the highly successful record made by the Department of Institutions during 1940 indicates that preventive measures and a carefully supervised parole system have been able to retard the total increase to an almost level population, it is unlikely that without drastic overhauling and replacement of what the State Fire Marshal justly defines as "hopelessly deteriorated" buildings it will succeed in withstanding the normal trend of growth.

The Division of Architecture is taking the following steps toward the present and immediate needs of the institutions as limited by the funds available or likely to be available for the purpose. In view of the main objectives which may be stated in very elementary terms as the *housing*, according to an accepted humanitarian standard, of those patients who are permanent or semipermanent wards of the State; and the *housing, treatment, and eventual discharge or parole* of as many patients as can be reasonably readjusted and returned to their communities, the Division of Architecture is conducting a series of

studies of the proportional "use" values of each item which goes into the finished building on the basis of classifying them into those features which are:

1. Desirable
2. Indispensable

In order that the money allotted may:

1. Produce an economical proportion of the above items.
2. Produce the highest percentage of features which lead directly to the main objectives.
3. Produce the most square feet of buildings with the least number of dollars possible and of the kind of building that will do the most good.

These latter three statements, it may be noted, are variations on the same theme and are uncomplicated and as mentioned before, elementary. They represent that which should be entirely obvious and a matter of routine. Their neglect, however, during close attention to what seem to be important detailed requirements, leads to the laying on of layer after layer of minor additional costs which in their sum total, may vitally restrict the accomplishment of these basic objectives.

INCREASED ENROLLMENT INDICATED

They are repeated now as a prelude to a briefly summarized look at the prospect in view for State institutions and in the light of this prospect, a drastic re-evaluation of that which is "desirable" and that which is "indispensable" becomes much less of a platitude and far more of a necessity in spreading the money to do the job.

From the report of Dr. Rosanoff, Director of the Department of Institutions, we find an indicated increase in enrollment of approximately 3,000 during the ensuing 4-year period. This is equal to one average State

(Continued on page 25)

Field Studies of Traffic Behavior

By K. A. MACLACHLAN, Highway Economist

IN ORDER to obtain more specific knowledge of the behavior of all types of motor vehicles under varying traffic conditions the Public Roads Administration has developed special equipment with which data may be gathered in the field. Information gathered by this equipment includes speeds, placement on the roadway, pertinent data regarding vehicles making passings under various conditions, and performance of trucks on grades.

Tests have been made utilizing this special equipment in several eastern States and for a six-weeks period in April and May, the Division of Highways cooperated with the Public Roads Administration in making similar studies on various sections of the California Highway System. The studies made in California were divided into three sections as follows: (1) Speed-placement studies; (2) Passing practice studies; and (3) Truck performance studies.

SPEED-PLACEMENT STUDIES

Speed placement studies furnished data on the speed of vehicles, the spacing between vehicles, and their transverse placement on the roadway. A total of twenty-six different sites were occupied for a period of from one to three days each. These sites included locations on 2, 3, 4 lane and 4 lane divided highways of various types of alignment and gradient and traffic conditions ranging from approximately 1,600 to 18,000 vehicles per day. An estimated 135,000 vehicles were observed and data recorded for each.

The speed of vehicles is obtained for this study by the action of the wheels on rubber detector tubes spaced normally 24 feet apart. Passage of the vehicle over the first tube operates a switch which in turn starts the operation of an electro-mechanical rotary stepping switch of the type employed in automatic telephony. Passage of the vehicle over the second tube similarly stops operation of the rotary switch at one of 50 contact points.

The point at which the switch stops is recorded on a strip chart which moves through a graphic recorder. These data are readily converted to miles per hour during analysis work. The strip chart is ruled into seconds and proceeds through the recorder at a constant speed such that the time interval between each vehicle may be obtained and, knowing the speeds, subsequently the longitudinal spacing between vehicles may be computed in feet.

Transverse placement of vehicles is obtained by use of a special placement cable located between the detector tubes. This placement strip is so constructed that the transverse location of vehicles is recorded to the nearest foot on a graphic recorder of the same type used in recording of the speed data.

PASSING PRACTICE STUDIES

The passing practice studies furnished data relative to the behavior of vehicles during passings under a wide range of traffic conditions. The equipment was designed to show all movements of vehicles within a one-half mile section indicating their transverse location by lanes, the direction of travel in that lane and the speed at any point in the test section. A total of ten sites all on 2 lane highways were selected, most of them located on roads of good alignment with a special interest in locations where passings would occur at relatively high speeds.

A total of approximately 50,000 vehicles were studied from which about 5,600 passings occurred. The analysis of these passings will show the speeds before, during and after passing of all vehicles involved, the length of road necessary to complete both single and multiple passings and other pertinent data.

EACH AXLE RECORDED

The equipment necessary to record these data consisted of detector tubes laid on the highway, spaced 50 feet apart and constructed with a pneumatic switch at each end of the tube

and a plug in the center of the tube to separate the lanes. These tubes are electrically connected with recorders such that the passage of each axle over every tube is shown on a strip chart moving through a graphic recorder at a constant speed.

A total of six recorders at three separate stations are used and are synchronized so that the movement of any vehicle may be followed through the entire test section and the time of passing from one point to another may be later scaled to 0.01 seconds and then converted into speeds in miles per hour. As each vehicle passed a given point in the section its type, if other than passenger car, was recorded on the chart.

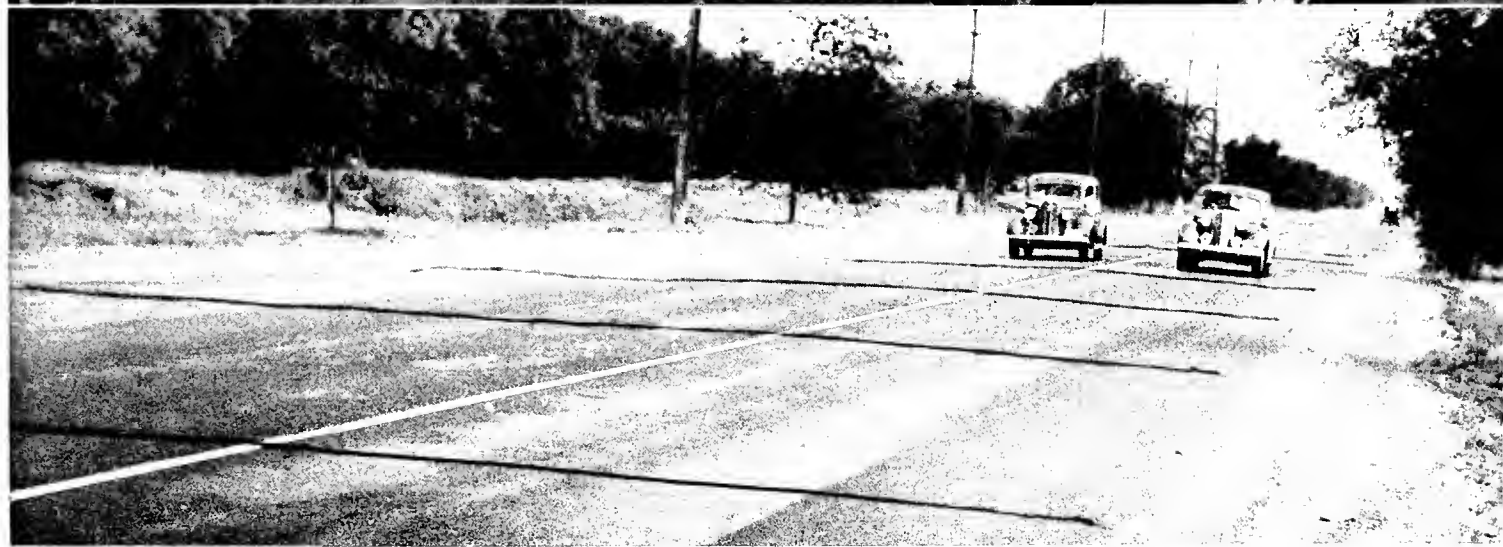
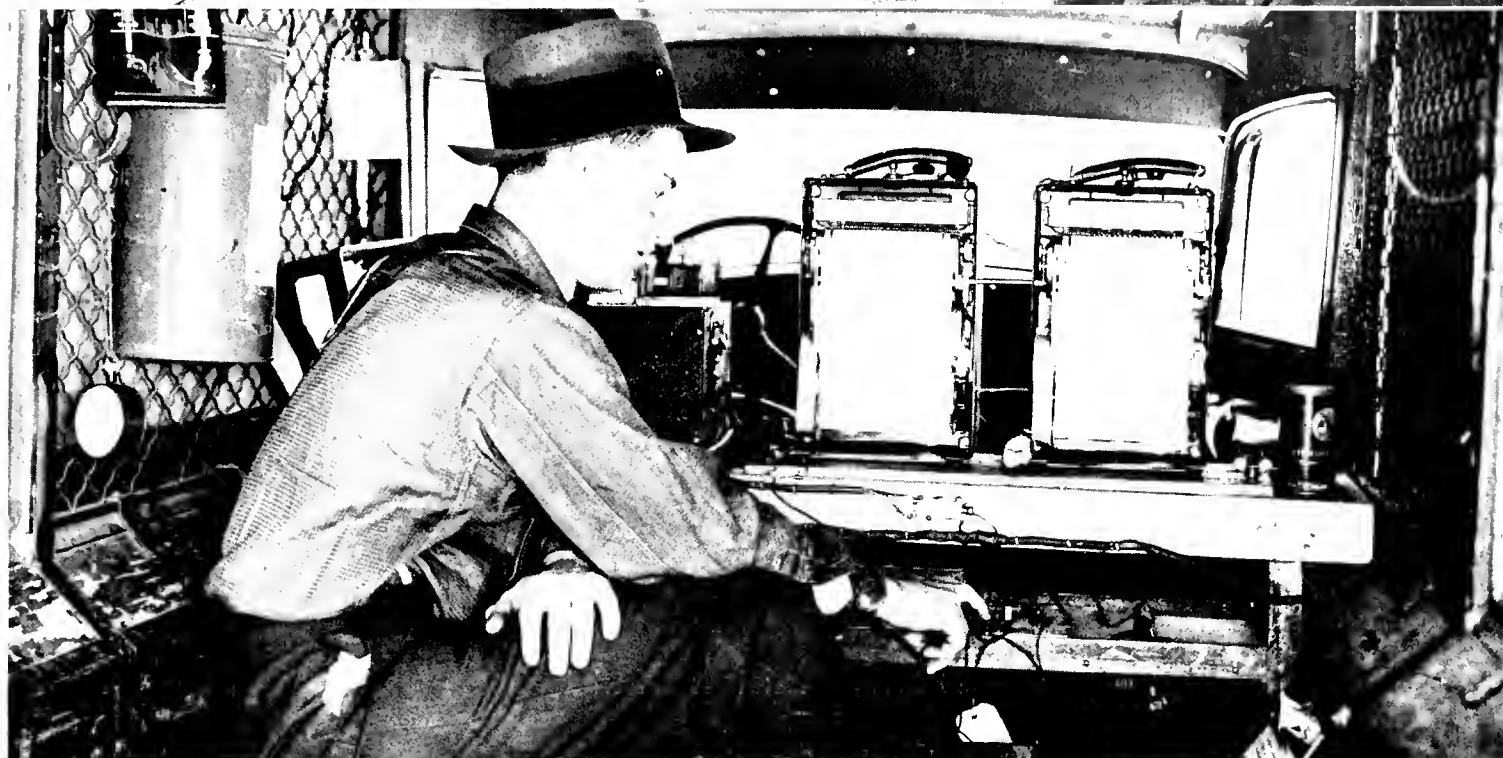
TRUCK PERFORMANCE STUDIES

Tests were made on the performance of various sizes of trucks with various loads on different grades. One purpose of this study was to compare data obtained with information gathered by the Public Roads Administration when it tested new trucks under various conditions.

Both the speed-placement and the passing study equipment were utilized for this study. All trucks passing the test section were weighed either at a pit-scale or by a loadometer party. At the time of weighing, data were recorded relative to the type, make, weight, engine size, transmission, etc. On passing the test section license numbers were recorded so that speeds were obtained for each truck to correlate with data obtained at the weighing station.

The several sites used in the truck performance study involved various gradients and were located at various altitudes in order to furnish information under different operating conditions.

The analysis of the field data obtained from these traffic behavior studies is now being carried out by the Division of Highways. The specific knowledge of the behavior of vehicles on our highways is bound to be a valuable aid in strengthening the design of future highways.



At top—Speed placement cables in operation on highway. Cable is secured with clamp in foreground. Center—Interior of equipment truck showing two graphic recorders on right. Typical installation for passing practice study. Recorders are concealed in olive grove at left background.



View of Coast Highway tunnel, ramps and overhead grade separation structure at Colorado Avenue intersection in Santa Monica.

Santa Monica Grade Separation

By R. C. MYERS, Assistant District Office Engineer

COMPLETION of the Colorado Avenue grade separation in the City of Santa Monica on July 13th has removed the hazard at what has been one of the most congested and dangerous spots for traffic along the Southern California Coast.

Northbound traffic on State Highway Route 60 passes under Ocean Avenue and Colorado Avenue in a tunnel on curved alignment. Traffic on Ocean Avenue and Colorado Avenue to reach the Palisades Beach Road (Route 60) formerly had to travel down the steep grade on Colorado Avenue from Ocean Avenue toward the beach and then make a right angle turn northerly approaching Route 60 that made a blind connection with northbound traffic on that route and approached the southbound traffic on a long curve where

the point of crossing on a very acute angle was always uncertain. Numerous collisions and near accidents were reported.

COMPLEX TRAFFIC PROBLEM

The problem was difficult of solution because Ocean Avenue and the Palisades Beach Road are parallel and only 200 feet apart, while the difference in elevation between them is about 35 feet. The abutting property is very valuable and highly improved with beach clubs, apartment houses, concessions, etc.

State Route 60 is one of the heaviest traveled highways in the State and the curved tunnel carrying said traffic under the City Park Lands and the two streets mentioned above, creates a situation which is quite complex.

To further increase the congestion,

large crowds wishing to use the Santa Monica Municipal pier were obliged to follow Colorado Street through the midst of this already overcrowded area. Sunday crowds using the recreational concessions on the pier, vary from 25,000 to 30,000 persons during the summer months.

On the other, or southerly side of Colorado Avenue, Appian Way extends into the beach area immediately southerly of the pier. Thus the three streets, Colorado Boulevard, Palisades Beach Road and Appian Way, joined at a common intersection with the intersection of Palisades Beach Road and Roosevelt Highway a few feet distant.

THREE-WAY INTERSECTION

To further aggravate this extremely annoying and dangerous traffic condition, Colorado Boulevard and



At top—Overhead structure across 4-lane Coast Highway at Santa Monica. Below—Tunnel and ramps at intersection with Appian Way.

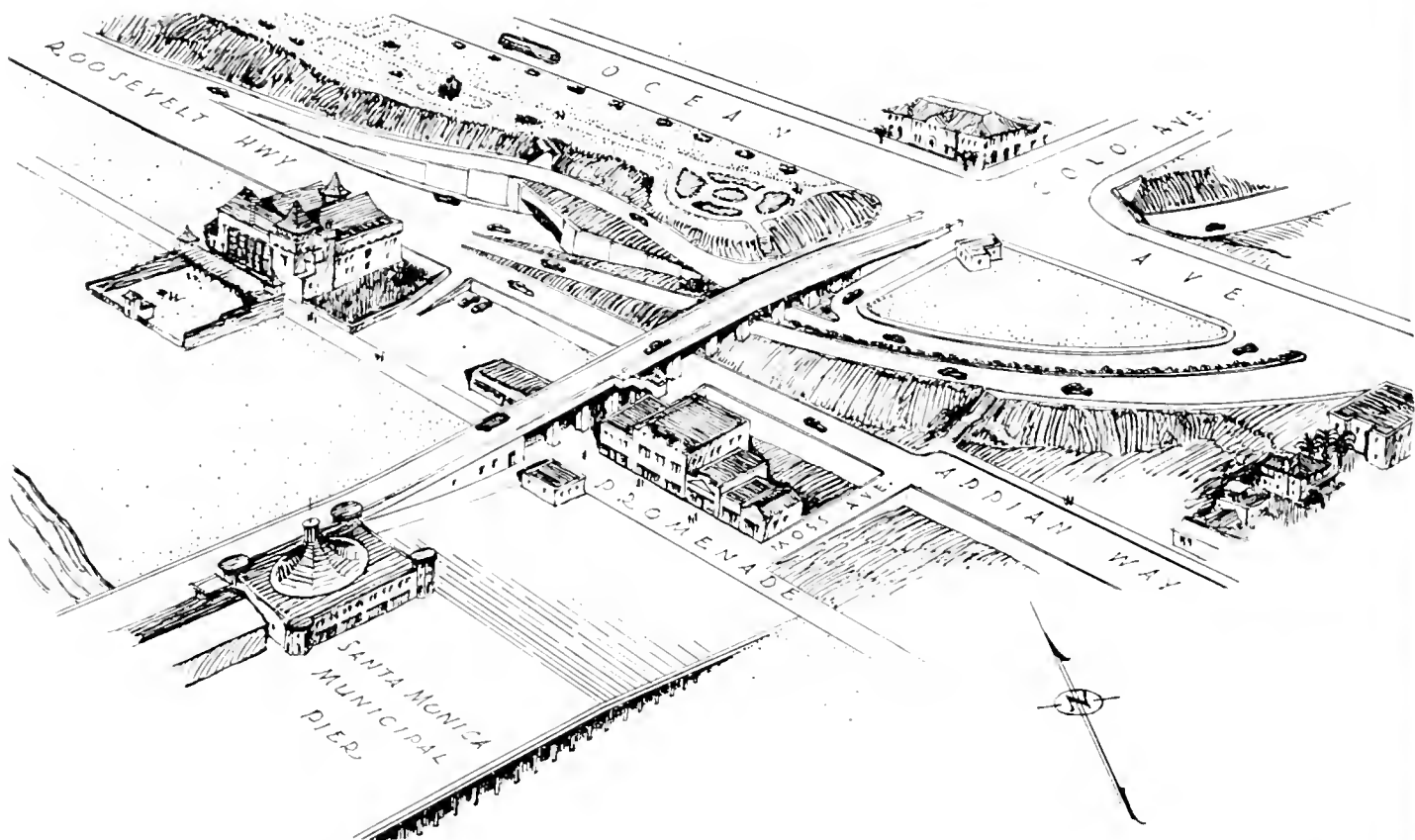
Ocean Avenue, with their heavy volumes of traffic, intersect at less than 200 feet from this three-way intersection.

For a number of years, this nar-

rowly confined area was subjected to an ever increasing traffic burden which finally became so acute and dangerous that the City of Santa Monica requested the State Division

of Highways, in cooperation with the City, the County of Los Angeles, and the P.W.A., to undertake its solution.

From this seemingly hopeless traf-



Sketch of grade separation at Santa Monica involving a tunnel, overhead structure crossing three highways and a wide promenade.

fic snarl emerged the idea of the so-called Colorado Avenue Grade Separation project which has been carried to a successful completion during the last year and one-half. Its opening has been in time to give relief to this crowded traffic condition for the greater part of the present summer season.

Traffic can now flow freely in practically any direction desired without interference from opposing or conflicting traffic. Turning movements are confined almost entirely to one-way right-hand turns with the consequent freedom from the annoyance and danger of traffic friction.

To accomplish these results a reinforced concrete viaduct having an overall length of 650 feet has been built along Colorado Avenue from Ocean Avenue to the pier. This structure carries two traffic lanes and two 4-foot sidewalks. The grade is elevated sufficiently at the crossings of Route 163 and the Appian Way connection to permit these two roads to pass underneath.

A one-way two-lane ramp carries southbound traffic on Roosevelt Highway wishing to continue southerly on Ocean Avenue, from a point

near the present tunnel entrance, under the Colorado Avenue structure up to a connection with Ocean Avenue whence it follows southerly along Ocean Avenue and other connecting streets to the Ocean Park area.

From this same location near the tunnel entrance, a two-lane road continues southerly along the ocean front, passing under the Colorado Street structure and connects with Appian Way and the beach area immediately southerly of the pier.

Northbound traffic on Ocean Avenue (Route 163), wishing to continue northerly along the Roosevelt Highway (Route 60) uses a two-lane ramp passing under the Colorado Avenue bridge and over an extension of the previously existing tunnel to connect with the Roosevelt Highway about 850 feet northerly of Colorado Avenue. Other short road connections have been made between this ramp and Ocean Avenue along each side of the bridge structure.

The project as a whole has included the widening and improving of Ocean Avenue (State Highway Route 163) from Colorado Boule-

vard to Pico Street and the further extension of this Route southerly to Bicknell Avenue. The City of Santa Monica engineering force worked with the Division of Highways in the preparation of plans for Route 163 from Colorado Boulevard to Bicknell Avenue.

The State prepared the plans for the Colorado Avenue separation structure and appurtenant roads and connections. The entire work has been accomplished under seven P.W.A. contracts, all of which were awarded by the City of Santa Monica. Inspection has been handled by State forces. The State and County aided the City in the acquisition of rights of way.

The cost of the project including surveys and plans, acquisition of right of way and construction, has been about \$554,000, contributed approximately as follows:

Federal Public Works Administration Funds.....	\$169,000
State Highway Funds, 1½¢ gas tax funds.....	98,000
½¢ State Highway gas tax, City of Santa Monica.....	139,000
County of Los Angeles funds.....	148,000
Total	\$554,000

California Traffic Operating Its Own Stop and Go Signals

By F. M. CARTER, Assistant Safety Engineer

THE State Division of Highways, in cooperation with several California cities, recently has installed stop and go signals which actually are timed by the traffic itself. This type of signalization is commonly known in the United States as Traffic Actuated Traffic Control; in Canada it has been called the "robot" system.

The system is based on the principle of operating traffic signals by the passing vehicles and consists of three major parts—the traffic signals, the traffic detectors and the control mechanism. Types used in California are semi-traffic and full-traffic actuated.

In semi-traffic actuation the detectors are placed in the minor highway approaches—in full-traffic actuation the detectors are placed in all approaches to record approaching traffic. The control mechanism receives the information from the detectors and assigns the right of way, by means of standard traffic signals, to the different streets in accordance with the traffic flow as indicated by the detectors.

THE TRAFFIC DETECTOR

The signals are mounted on standard posts—and are of the national standard three-color type with red, amber, and green lenses. The amber light is shown as a clearance interval only to the street losing the right of way and not to the street receiving the right of way. This method has the advantage of preventing the dangerous practice of starting on the amber light before the green. At all intersections the signals are located on the far right-hand corner of each approach in conformity with accepted national practice.

The traffic detector is a contact-making device connected to a relay in the control mechanism and actuated by the pressure of a wheel passing over it at any point. One or more detectors are installed in each ap-

proach to the intersection in the normal traffic lane. Detectors are placed in the pavement with their surfaces flush with the surface. They are located in the approach a distance of from seventy-five to one hundred and fifty feet from the intersection depending upon the required braking and stopping distance for the normal speed of approaching traffic.

In addition to the vehicle detectors, trolley detectors are used where electric trains use the intersection. Push buttons also may be installed for pedestrians.

THE CONTROL MECHANISM

The control mechanism is the most important part of the robot system. Its function is to receive the impulses from the detectors and then assign the right of way, by means of the signals, in accordance with the traffic demand from instant to instant, as indicated by the detectors.

This controller or dispatcher accurately registers, remembers and responds to actual traffic demands. The robot system divides the traffic cycle into an initial "go" interval, a vehicle "go" interval, an amber or cautionary interval and a red or "stop" period.

The maximum time which traffic after passing over a detector will be required to wait for the green signal is predetermined and set on the dispatcher. All intervals are separately adjustable for each thoroughfare and are easily changed by the means of knobs on the face of the dispatcher.

OPERATION OF SIGNAL

A car approaching the "red" light places an impulse in the dispatcher by crossing the detector. This impulse immediately takes the green light away from the opposing highway traffic and lights the "amber" light. The "amber" light is predetermined for three seconds. With the detector placed approximately one hundred and twenty feet from

the entrance to the intersection, a car traveling twenty-five miles per hour would require approximately three seconds to reach the intersection when the green light should show so as to permit the approaching car to continue without changing gears.

If the intersection is being used by traffic on the opposing highway, the waiting cars are given the right of way at the first break in the opposing traffic. If no break appears naturally in the opposing traffic, this traffic is automatically stopped at the end of the predetermined maximum period and the waiting cars given the right of way.

When continuous traffic on either highway is stopped by the operation of the maximum period to allow waiting traffic on the other highway to use the intersection, the right of way reverts at the first opportunity (or at the end of the maximum period) to the highway on which the continuous traffic was interrupted.

DISPATCHER REMEMBERS

Each car approaching the intersection against the "red" signal at a time when the other highway is using the right of way is automatically recorded and remembered by the dispatcher so that the right of way will later be transferred to it without the necessity of recrossing the detector.

The time of the "green" signal period on each highway is governed by the flow of traffic on that highway, each vehicle approaching the intersection and crossing the detector extends the "green" interval sufficient time for that vehicle giving the impulse to reach the center of the intersection. This "green" interval is extended as long as vehicles cross the detector up to the maximum period for that highway. The control, therefore, allows only such time as is actually needed on each highway in accordance with the immediate traffic demands. The timing of the traffic periods is thus automatically ad-

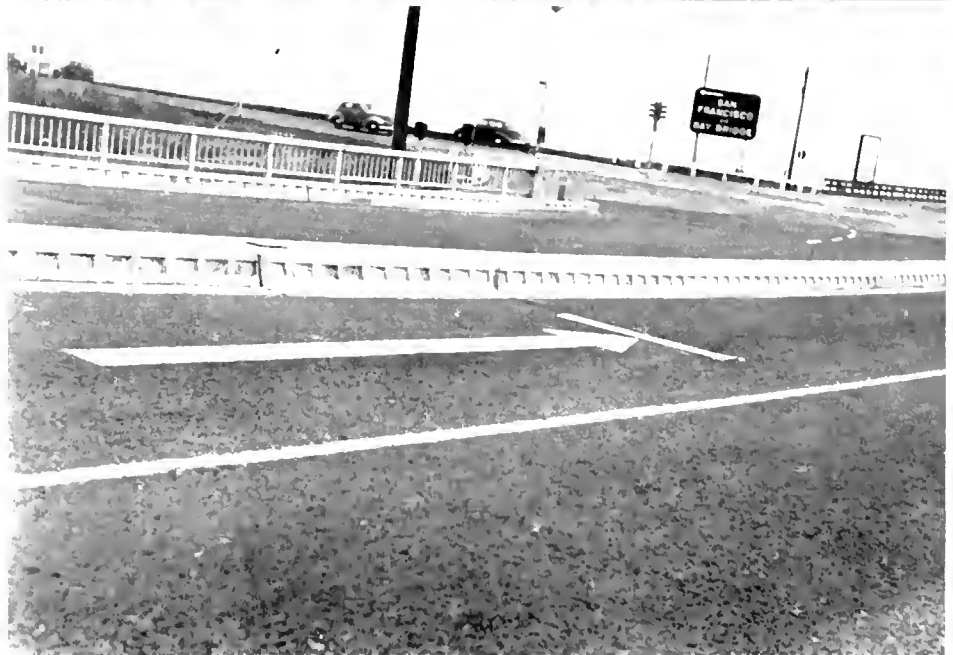


justed by the traffic itself and from instant to instant. The wide variation of the green period as determined by the actual traffic from cycle to cycle is of considerably greater importance than the variation in the total cycle, due to the wide fluctuation in the distribution of the "green" signal between the two movements.

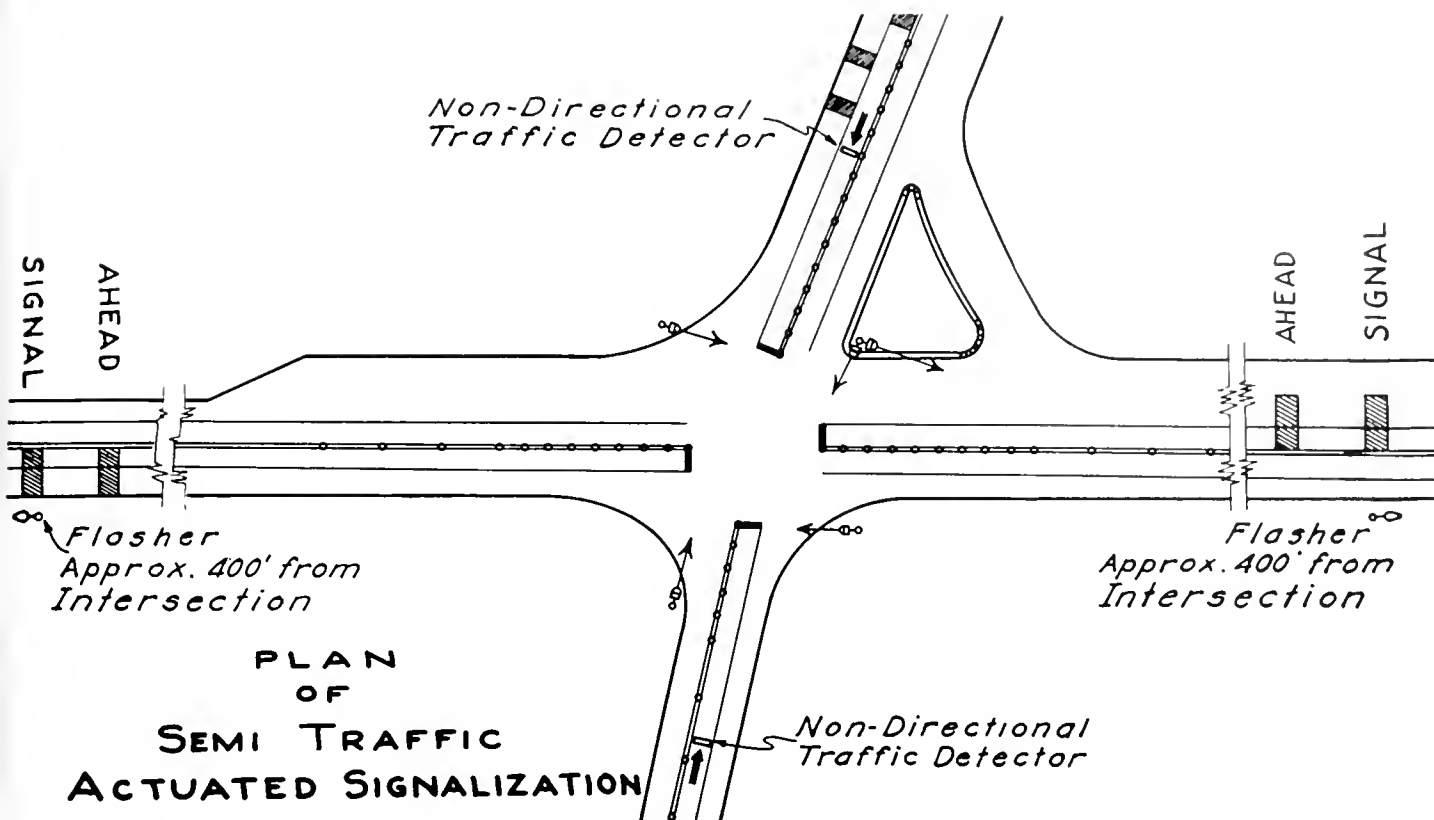
OPERATED 24 HOURS

This vehicle-actuated system is operated continuously. Since the objection to all night operation is removed by the elimination of unnecessary stops and delays. The safety element of continuous operation is thus retained.

While it is only recently that this traffic-actuated type of control has been installed in California, there are at this time eleven installations in the State and five being installed or out for bids. Two are full actuated systems, the remainder are semi-traffic actuated.



At top—Traffic actuated signal on East Shore Highway (U. S. 40) at Berkeley. Car in foreground has crossed pavement detector and is entering intersection. At bottom, arrow points to signal control treadle or traffic detector which is operated by wheel of car passing over it.



Sketch showing installation plan of semitraffic actuated signalization and location of flashers and non-directional traffic detectors.

The first installation of this type of control in California was installed by the city of Berkeley at the intersection of the Eastshore Highway (U. S. 40) and University Avenue. At this intersection there is a heavy left-turn traffic from University Avenue in the morning. These signals operate on a 30-second cycle—with an initial period of six seconds, a vehicle interval of four seconds, three seconds of amber for clearance intervals and a minimum of fourteen seconds of green for the Eastshore (major) highway. These signals have been operating continuously since they were placed in use and none but favorable comments have been heard.

Just recently the city of Palo Alto installed a full traffic actuated system at the intersection of El Camino Real (U. S. 101) and Embarcadero—adjacent to the campus of Stanford University. The initial interval of six seconds and the vehicle interval of four seconds is the same on both highways. The difference in the approach speeds is taken care of by the distance of the detectors from the intersection.

The detectors on the El Camino Real are one hundred and thirty feet from the intersection and those on Embarcadero are ninety feet. Ad-

vance yellow flashers with "Signal Ahead" signs are positioned about four hundred feet in advance of the intersection. These flashers operate only during the yellow and red intervals.

A semitraffic-actuated system has recently been installed at the intersection of Garvey Avenue (U. S. 60-70-99) and Rosemead Avenue (State 19), and a full-actuated system is being installed at the intersection of Garvey Avenue and San Gabriel Avenue, both in Los Angeles County.

Motorists and traffic officers are high in praise for these traffic control devices. They soon find that if the approach to an intersection under traffic-actuated control is made at a reasonable speed, and in the absence of opposing traffic, a motorist will be able to proceed on through without reducing gears.

From the point of view of the vehicle driver the traffic-actuated system of traffic control has a definite appeal—he feels as if he were a part of the system. It is his movement that times the signals. He does not have to wait unless other traffic is moving. The majority of our motorists are courteous—they do not become irritated by delay when there is an apparent reason for it.

Road Construction Test Track Built

(Continued from page 14)

ments will be made periodically to determine relative increase in roughness under traffic of the different types of construction.

ACKNOWLEDGMENT

The investigations and tests described in this article are being conducted as a research project of the California Division of Highways on the approval of Director of Public Works Frank W. Clark at the initiation of State Highway Engineer Chas. H. Purcell. The Surveys and Plans, Construction, Maintenance and Materials and Research Departments collaborated in the development of the specifications for the construction and conduct of the test.

His car took him from his home to the office.

The lift took him from the vestibule to his own particular room.

His secretary took it down when he wished to write a letter.

And he could always reach the telephone without rising from his chair.

So naturally the great morning paper welcomed his views on the exhausting rush of modern business life.

Two Grade Separations to Solve Palo Alto Traffic Problem

By E. L. WALSH, Associate Bridge Engineer

TWO GRADE separations are now under construction in Palo Alto. Both structures, only 550 feet apart, are on University Avenue, which serves as a main connection between Stanford University and the business section of the town. One separates University Avenue from the main line of the Southern Pacific Railroad; the other, on El Camino Real, separates the State highway from the heavy cross-traffic on University Avenue.

These two structures with their appurtenant connections and service roads are combined to make a complete project and will provide free and uninterrupted travel at this point by channelizing the through State Highway (U. S. 101) and local traffic. The layout, with its dividing curbs, islands, service roads, and warning lights, will preserve continuity of traffic and thus avoid the delays

and traffic friction coincident with the existing situation.

Work was started on the Southern Pacific separation November 21, 1939, by Contractor P. J. Tyler. The contract is now 60 per cent complete.

On June 11, 1940, a second contract for grading and paving with asphalt and Portland cement concrete on El Camino Real was awarded to the Union Paving Company of San Francisco.

A third contract was awarded to Earl W. Hepple on July 15, 1940, for constructing a reinforced concrete rigid frame structure which will carry University Avenue traffic over El Camino Real.

RAILROAD SEPARATION STRUCTURE

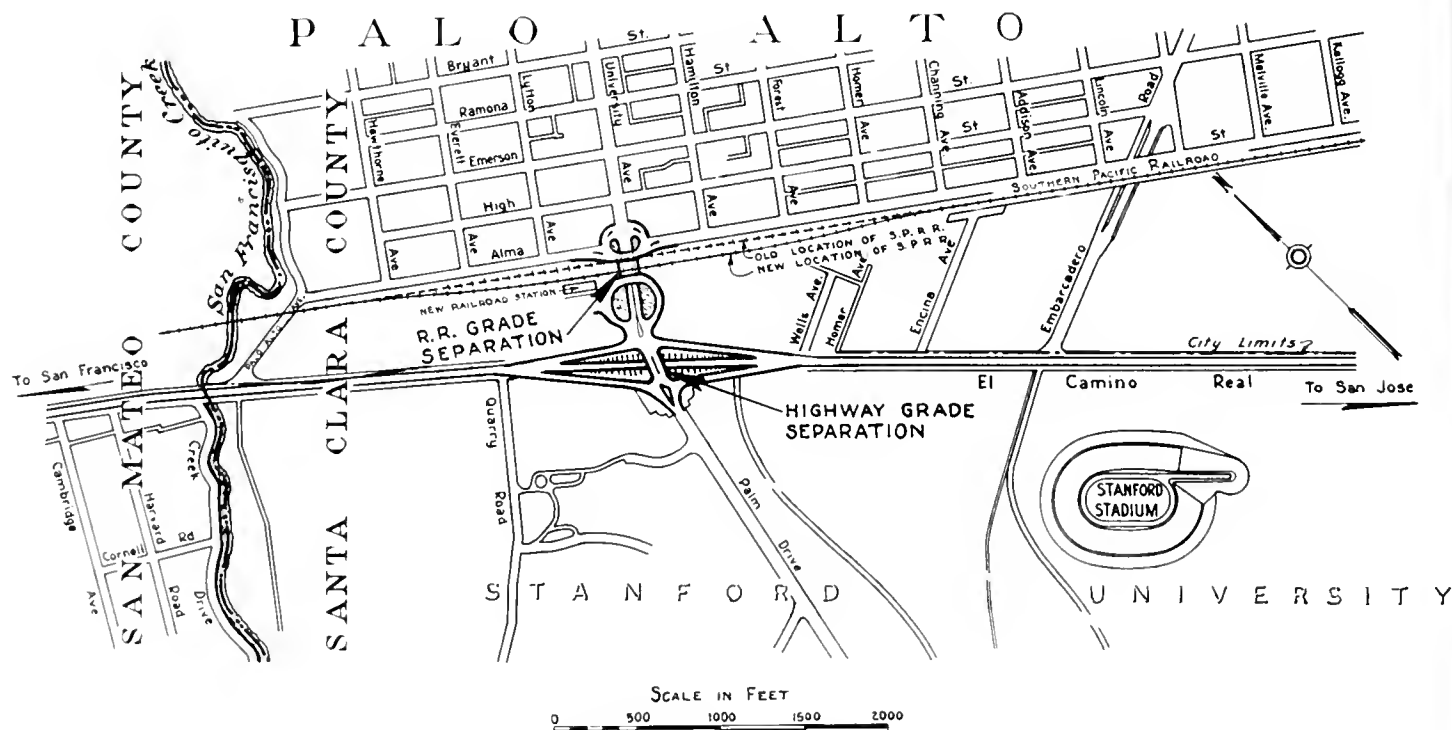
The main difficulty in constructing a subway under the tracks of the railroad was due to the proximity of the tracks to the large buildings of the

business section of town. There was insufficient distance to depress the roadway under the tracks and return to natural ground level on a suitable grade before reaching the business frontage.

Therefore, it was necessary to elevate the railroad tracks five feet, in conjunction with moving them laterally approximately 80 feet. Such an extensive change required the rearrangement and channelization of the existing connecting streets, relocation of the railroad company's freight and passenger facilities, and the relocation of numerous underground and overhead public utilities.

To maintain uninterrupted train service it has been necessary to construct the structure in two steps. The first operation confined all activities to the south side of the tracks. The

(Continued on page 27)



State Institutional Building Picture

(Continued from page 15)

hospital institution complete. Existing conditions of overcrowding in the State institutions as quoted from the State Fire Marshal's survey, the findings of which are, in general, not overstressed, amount to an additional 6,000 patients.

In the absence of a very large appropriation or bond issue to take care of this overwhelming load, the work of the Division of Architecture will consist of the undramatic duty of studying each individual item which goes into a building and each operation which goes into its fabrication with the idea of accomplishing all of that which is "indispensable" and as much of that which is "desirable" as is possible.

FUNCTIONAL DESIGN

This promptly brings us into the field of what is termed "functional design." "Functional design" reduced to simple language means the use of the things that do the work to also provide the external and internal visible appearance.

"Functional design" may or may not look odd to the layman according to the skill of the designer. It is the intention of the Division of Architecture to design buildings which represent a sound long term investment for all of the people of the State while making use of all the possible advantages of recent improvements in materials and equipment as well as to maintain respect for the traditions and tastes of the communities in which these buildings are erected.

In Memoriam

Robert Leroy Jones, 53, Deputy State Engineer in Charge of Flood Control and Reclamation, Department of Public Works, State of California, passed away at his home early on September 12th as a result of heart failure.

Mr. Jones was born in Laramie, Wyoming, June 15, 1887, and attended the Denver, Colorado, high schools, University of Denver, and University of California at Berkeley.

He started work under his father, R. M. Jones, a well-known Consulting Engineer of Denver, Colorado, doing general electrical and hydraulic engineering work in Wyoming, Colorado, and Mexico until 1910. At that time he came to this locality as the Principal Assistant Engineer of Reclamation District No. 1500 in Sutter County. In 1917 he was called from this position to become Chief Engineer of the Sutter Basin Company at Robbins, California. In 1921 he left this position to join the engineering staff of the State of California.

His early work with the State was in the positions of Associate Hydraulic Engineer, Division of Engineering and Irrigation, Department of Public Works; Chief Assistant Engineer, State Reclamation Board. In 1929 he was promoted to the position of Deputy State Engineer in Charge of Flood Control and Reclamation for the Department of Public Works. This is the position he occupied at the time of his death. In this position he was in charge of all flood control maintenance for the State Engineer's office. This included not only the Sacramento Flood Control project, but work for and with other departments and divisions of the State in many rivers of the State and at times in the Pacific Ocean.

Following the floods of the winter of 1937-38 he was in charge of the extensive work of flood repair and rehabilitation in the northern half of the State involving the expenditure of several million dollars.

Mr. Jones was recognized as an authority on flood control and reclamation work in the Sacramento Valley. His engineering work here was outstanding and he was prominent in the development of the modern engineering trend of flood control practice. His passing is a distinct loss to all residents of the Central Valleys and his counsel and advice will be particularly missed by the reclamation districts in this area.

Probably no one man was as well acquainted with the complex flood problem of the Sacramento River Flood Control Project and as well equipped to handle them as Mr. Jones.

He has been active in the affairs of the American Society of Civil Engineers since 1917. For the ten years prior to 1932 he was a director of the Sacramento Municipal Utility District. He was affiliated with the Tehama Lodge No. 3, Free and Accepted Masons, and was intensely interested and active in Boy Scout work in the Golden Empire Council area.

He is survived by his wife, Mrs. Nellie N. Jones, and six children, Robert J., Barton L., Patricia, Dorothy Ann, Emily Rose and William Stephen, and four brothers, Barton Jones, a well-known and prominent Consulting Engineer with the Tennessee Valley Authority; Kirby V. Jones, Engineering Executive of the Firestone Rubber Company in Akron, Ohio; Allen Jones of Quincy, Mass.; and Paul Jones of Schenectady, N. Y.

Funeral services were held at the James R. Garlick chapel at 10.30 a.m., Saturday, September 14.



ROBERT LEROY JONES

World Record for Toll Spans Set by Bay Bridge August Traffic

FOR THE month of August another all-time record for traffic was established on the San Francisco-Oakland Bay Bridge. A total of 1,668,627 automobiles, trucks, buses, etc., crossed the span during this busiest of all months. It is believed that this figure is an all-time record for toll structures throughout the world.

The total collections for the month were \$456,779, which was \$25,440 less than the same month a year ago.

On Sunday, August 25, traffic totaled 68,752, which has only been ex-

ceeded on one occasion and that was the Sunday following the opening of the bridge in 1936. The lowest day was Tuesday, August 6, when 47,674 vehicles crossed.

The total amount of traffic, exclu-

sive of that to the Exposition, was remarkable and amounted to 1,404,286 vehicles.

August traffic on the San Francisco-Oakland Bay Bridge and comparative figures are:

	August 1940	August 1939	July 1939	Total Since Opening
Passenger autos and auto trailers----	1,543,477	1,038,555	1,413,564	36,275,360
Motorcycles and triars-----	4,811	4,316	4,588	160,554
Buses-----	27,423	17,466	26,547	610,125
Trucks and truck trailers-----	71,550	50,529	68,421	1,756,693
Others-----	21,366	16,662	20,809	612,107
Total vehicles-----	1,668,627	1,127,528	1,533,929	39,414,839

Building Six Bridges and Subway on Dixon-Davis Realignment

By R. E. PIERCE, District Engineer

IN THE March, 1940, issue of CALIFORNIA HIGHWAYS AND PUBLIC WORKS appeared an article regarding the starting of construction on the alignment of U. S. 40 between Dixon and Davis. Since that article appeared, the grading and minor drainage structures included in the original contract have been practically completed. Work is well under way on the contract for the new subway under the Southern Pacific about 0.7 mile south of Davis as well as another contract, including six bridges, which is just getting under way.

The first 5 miles of this project is graded for two lanes located off the center of the right of way so as to conform to an ultimate four-lane divided highway. The balance of 2.3 miles is graded for a four-lane divided highway.

SUBWAY 62½ FEET WIDE

About 1.5 miles from the Dixon end of this project a short section of divided highway has been graded in order to provide better facilities to care for traffic at the intersection here with the present road leading to Woodland and up the west side of the Sacramento Valley.

The subway now under contract consists of a steel and concrete structure which will provide two twenty-seven foot roadways with a six-inch dividing strip and two four-foot sidewalks.

The bridge contract, just getting started, includes six reinforced concrete bridges. This is three more than was originally planned, due to conditions observed during the unusually high water in Putah Creek during February of this year. They are to be constructed in the area to the south of South Fork, which was flooded in the overflow from Putah Creek. These three bridges are each 52½ feet long.

The bridge over South Fork is 478 feet in length and the two bridges over Putah Creek, built to accommo-

Washington Orders It EXECUTIVE OFFICE OF THE PRESIDENT

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Washington, D. C.

California Highways and
Public Works
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Gentlemen:

It will be greatly appreciated if you can make available without cost, for the official use of the Bureau of the Budget, the publication listed below. If there is a charge for this publication, please endorse the amount in the space below and return this letter so that an official order may be placed. An addressed frank is enclosed for your use.

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Your courtesy will be sincerely appreciated.

Very truly yours,

(Mrs.) Marcella S. Heartshorn
For the Library

Mattis, George. Channelizing traffic in Oakland. Calif. Highways and Pub. Works, P. O. Box 1499, Sacramento, Feb. 1940, P. 12-13, 18, 27.

date the divided highway, are each 210 feet long.

Each bridge will provide a clear roadway width of 27 feet and two one-foot nine-inch sidewalks.

This project makes an important improvement on this route which is

the principal cross-state highway in Northern California, joining as it does the metropolitan area surrounding San Francisco Bay and passing through Sacramento and on across the State line to the east.

The distance will be shortened 3.25 miles and the curvature will be reduced from 612 degrees to 144 degrees. Five of the curves on the old road are right angle turns of short radii. The new location also in bypassing Davis eliminates passing through traffic on narrow city streets at reduced speed. The new road is provided with adequate rights of way for the ultimate divided two-way roadways.

State Buys Carquinez and Antioch Spans

(Continued from page 6)

of Public Works emphasized the fact that State acquisition of the structures will not cost the taxpayers of California a cent.

"Under the reduced tolls on the bridges made effective by the State, the motoring public will be saved approximately \$4,000,000 during the next seven and one-half years, within which time it is expected the revenue bonds will have been retired and the bridges made toll free."

The Carquinez Bridge consists of a center tower span of 150 feet and two side towers with cantilevers and suspended spans of 1100 feet each. The north anchor span of 500 feet reaches a pier located on the bluff; the south anchor span of 500 feet connects with an approach viaduct giving an overall length of 4482 feet.

The Antioch Bridge consists of one 320-foot steel lift span and one 320-foot fixed span, 2078 lineal feet of deck truss spans on towers, and 1921 lineal feet of reinforced concrete trestle, making an overall length of 4639 feet.

Grade Separations to Solve Palo Alto Traffic Problem

(Continued from page 24)

concrete abutments and center pier at the new track location were completed and structural steel to support the tracks was placed in final position. Railroad traffic was transferred over the new structure in its ultimate location on August 28.

TEMPORARY RAILROAD STATION

Work is now in progress tearing up the old tracks and excavating for the north portion of the structure. The abutments and center pier will be extended and the superstructure placed to provide a through connection for Alma Street traffic.

During the time the contractor has been engaged with construction of the subway proper, he has also constructed a temporary passenger station to serve railroad patrons since the new location of the tracks necessitated the demolition of the old station. At the same time, the Southern Pacific Company has removed the old passenger station and started work on a new one.

While work is in progress north of the tracks vehicular traffic will be inconvenienced in traveling between Alma Street and University Avenue. It will be necessary to limit traffic to one-way only because of the extent of work at this intersection.

EL CAMINO REAL SEPARATION

Traffic which prior to construction used University Avenue between El Camino Real and the town of Palo Alto now is detoured from the north, via Palo Alto Avenue and Alma Street. Traffic from the south reaches town via Embarcadero Road. A subway under the tracks at Embarcadero Road was constructed from Federal funds under State supervision in 1936.

At the intersection of El Camino Real and University Avenue the State Highway (El Camino Real) will be depressed to go under the reinforced concrete rigid frame structure which will carry University Avenue traffic.

The depressed portion of the underpass is 2,600 feet long and comprises 49,000 cubic yards of roadway excavation. In the depressed portion along El Camino Real there will be two roadways of 35-foot width, separated by a six-foot dividing strip.

Outstanding Safety Need says Barrett

Larry Barrett, Chairman of the California Highway Commission, has issued the following statement:

"The proposed conversion of the Bayshore Highway from San Francisco to Palo Alto into a freeway is one of the most important, if not the greatest, highway project undertaken to date by the State.

"Governor Olson, Director of Public Works Frank W. Clark, and the Highway Commission feel that it is absolutely necessary, in view of the high accident rate on the Bayshore Highway and the ever increasing traffic congestion, that this project be started at the earliest possible moment.

"While the cost of the project in its entirety will be tremendous, the saving of life and property and the relief of dangerous traffic conditions will fully justify any expenditure required to make the Bayshore Highway a modern safe route. As a resident of San Mateo County, and with my business interests in San Francisco, I have had occasion over a period of years to travel the Bayshore Highway at least twice a day and I know the hazards to motorists that exist there today.

"I think the launching of this project will be hailed as one of the outstanding achievements of the present State administration."

A four-foot walkway on each side is provided. At natural ground level flanking El Camino Real, connecting roads are to be constructed which will provide interconnecting links between University Avenue and El Camino Real.

The structure over El Camino Real will provide two 35-foot roadways separated by a four-foot dividing

curb. Eight-foot sidewalks are provided on each side for pedestrians. The total length of the structure will be one hundred forty-six feet, consisting of two central spans of forty-six feet, six inches, and two end spans each twenty-six feet, six inches long.

The project is to be extensively landscaped with trees and shrubbery. In designing the landscaping for such a project with its channelized drive-ways, considerable study is given not only to harmonious and attractive appearance but also to the type and location of the plants in relation to driving safety, so that no "blind spots" will result. Several existing trees which are matured are to be replanted at new locations.

The railroad separation is being financed from 1939 Works Program Grade Separation Funds. The city of Palo Alto acquired the necessary additional right of way.

A COOPERATIVE PROJECT

The El Camino Real Separation is being financed from State highway funds and 1941 Fiscal Year Federal Aid. The city of Palo Alto is financing its share from quarter-cent funds allocated for use on city streets of major importance.

It is anticipated that the project will be completed and thrown open to traffic by January 1, 1941. The total cost of the completed project, exclusive of the betterments to the Southern Pacific Railroad facilities, the cost of which is being borne by the railroad company, will be approximately \$520,000.

George W. Thompson is the Resident Engineer for the State.

EXCLUSIVE READING MATTER

California Highways
and Public Works,
Messrs.,

I have seen the magazine you put out and it is a very interesting one.

I would like you to send it to me because it covers things you don't get in other magazines.

Mark H. Lamb
Visalia, Calif.

A high-school girl, seated next to a famous astronomer at a dinner party, asked him, "What do you do in life?"

He replied, "I study astronomy."

"Dear me," said the girl. "I finished astronomy last year."

Highway Bids and Awards for the Month of August, 1940

CALAVERAS COUNTY—A reinforced concrete slab bridge at Six Mile Creek. District X, Route 65, Section C. M. J. B. Construction Co., Stockton, \$4,600; O. J. Scherer Co., Angels Camp, \$4,755; A. A. Tieslau, Berkeley, \$5,276. Contract awarded to T. C. Tunsen, Modesto, \$3,402.

FRESNO COUNTY—Across Big Creek 0.6 mile south town Big Creek, remove existing timber bridge and construct new concrete slab timber bridge. District VI, Route 76, Section D. Thomas Construction Co., Burbank, \$12,174; McClain Company, Los Angeles, \$12,734; L. D. Tonn, Lodi, \$14,648. Contract awarded to J. E. Anderson, Visalia, \$9,751.

FRESNO COUNTY—Across Kings River sloughs 6.5 and 7.3 miles northwest of Reedley, two timber bridges with reinforced concrete decks to be constructed. District VI, Feeder Road, Trewitt, Shields & Fisher, Fresno, \$18,573; F. Kaus, Stockton, \$19,483; J. J. Munnemann, Santa Barbara, \$20,000; A. S. Vinnell Co., Alhambra, \$20,815. Contract awarded to F. Fredenburg, South San Francisco, \$18,428.

HUMBOLDT COUNTY—At Shively and Greenlaw Bluffs, about 0.3 mile, to be graded and surfaced with plant-mixed surfacing, and slope protection work to be constructed. District I, Route 1, Section D. E. R. E. Campbell, Los Angeles, \$73,168; Fred J. Maurer & Son, Eureka, \$92,884; Harold Smith, St. Helena, \$99,729; E. E. Smith & N. M. Ball Sons, Berkeley, \$102,690; Engineers, Ltd., Sacramento, \$118,979. Contract awarded to Joseph Shaw, Crescent City, \$69,411.

MADERA COUNTY—Across Chowchilla River, 2.5 miles north of Chowchilla, a reinforced concrete slab bridge. District VI, Route 4, Section C. F. Fredenburg, South San Francisco, \$13,857; Thomas Construction Co., Burbank, \$14,990; M. J. B. Construction Co., Stockton, \$15,982; Trewitt-Shields, Fisher, Fresno, \$16,095; Frank J. Reilly, San Francisco, \$18,017; Marshall Hanrahan, Redwood City, \$20,790. Contract awarded to McClain Co., Los Angeles, \$13,127.

MARIN COUNTY—Furnish and install truck scale about 2.5 miles north of San Rafael. District IV, Route 1, Section A. Toledo Scale Co., New Jersey, \$4,934; William D. Rapp, Santa Rosa, \$5,603; Leibert & Trobeck, San Rafael, \$6,600. Contract awarded to Mario Bottini, San Rafael, \$4,667.

MONO COUNTY—Between Grant Lake and junction with Route 23, near Rush Creek, 1.3 miles to be graded and penetration oil treatment applied. District IX, Route 111, Section A. R. E. Campbell, Los Angeles, \$14,890. Contract awarded to Basich Bros., Torrance, \$7,954.

MONO COUNTY—At Soda Creek, 28 miles northwest of Bridgeport, remove existing bridge and construct reinforced concrete bridge. District IX, Route 13, Section A. Campbell Construction Co., Sacramento, \$12,733; Thomas Construction Co., Burbank, \$12,978; A. S. Vinnell Co., Alhambra, \$14,250. Contract awarded to A. A. Tieslau, Berkeley, \$9,712.00.

MONTEREY COUNTY—Between Gonzales and Salinas, about 16 miles, imported borrow to be placed on shoulders and road-mix surface treatment applied thereto. District V, Route 2, Sections C. B. Brown & Doko, Pismo Beach, \$20,160; Granite Construction Co., Watsonville, \$21,910; L. A. Brisco, Arroyo Grande, \$22,586; J. E.

Haddock, Ltd., Pasadena, \$22,664; L. C. Karstedt, Watsonville, \$24,446; Lee J. Immel, Berkeley, \$26,068. Contract awarded to J. A. Casson Co., Hayward, \$17,928.

ORANGE COUNTY—Across Santiago Creek at the city of Orange, a reinforced concrete bridge to be constructed and about 0.34 mile of roadway to be graded and surfaced with plant-mixed surfacing. District VII, Route 43, Section A, Orange. Oberg Bros., Los Angeles, \$47,881; J. S. Metzger & Son, Los Angeles, \$48,522; J. E. Haddock, Ltd., Pasadena, \$48,899; Dimmitt & Taylor, Los Angeles, \$49,019; Byerts & Dunn, Los Angeles, \$51,648; Vido Kovacevich, South Gate, \$52,724; Carlo Bongiovanni, Hollywood, \$53,443; Chas. H. Johnston, Los Angeles, \$55,946; Griffith Co., Los Angeles, \$56,828. Contract awarded to Werner & Webb, Los Angeles, \$46,388.

PLACER COUNTY—Between Homewood and Tahoe City, about 1.5 miles of plant-mixed surfacing to be placed over the existing traveled way. District III, Route 38, Section A. A. Teichert & Son, Inc., Sacramento, \$8,900. Contract awarded to Independent Construction Co., Oakland, \$7,385.

RIVERSIDE COUNTY—Construct timber approach spans across Colorado River at Ehrenberg and extend bridges across Teed and Acari ditches District XI, Route 64, Sections C, D, E. A. S. Vinnell Co., Alhambra, \$18,620; W. H. Barber, San Diego, \$15,388; R. E. Hazard & Sons, San Diego, \$19,948; R. J. Daum, Inglewood, \$23,898. Contract awarded to Thorstan & Dahl, Los Angeles, \$12,824.

RIVERSIDE COUNTY—Between three miles west of Riverside and Riverside, about 3 miles to be graded and surfaced with plant-mixed surfacing on cement stabilized base. District VIII, Route 19, Section A. Oswald Bros., Los Angeles, \$109,946; J. E. Haddock, Ltd., Pasadena, \$115,843; Griffith Co., Los Angeles, \$124,876; Claude Fisher Co., Ltd., Los Angeles, \$137,348; Basich Bros., Torrance, \$143,463. Contract awarded to Matich Bros., Elsinore, \$106,485.

SAN BERNARDINO COUNTY—Concrete slab bridge at Cable Creek, 3 miles northwest of San Bernardino. District VIII, Route 31, Section A. Matich Bros., Elsinore, \$12,866; A. S. Vinnell Co., Alhambra, \$12,985; C. R. Butterfield-Kennedy Co., San Pedro, \$14,746; Carl Hallin, Los Angeles, \$15,674. Contract awarded to Oberg Bros., Los Angeles, \$12,423.

SAN DIEGO COUNTY—At Barnett Ave. and Rosecrans St., between Miramar Road and Torrey Pines Reservoir, about 2.6 miles to be graded and surfaced with asphalt concrete, portland cement concrete and plant-mixed surfacing. District XI, Route 2, Section S.D. B. G. Carroll & H. L. Foster, San Diego, \$52,656; Griffith Co., Los Angeles, \$54,289; V. R. Dennis Construction Co., San Diego, \$56,103. Contract awarded to R. E. Hazard & Sons, San Diego, \$49,466.

SAN DIEGO COUNTY—Between Oak Grove and 0.8 mile north, about 0.8 mile to be graded, roadmix surface treatment to be applied and a reinforced concrete bridge across Chihuahua Creek to be constructed. District XI, Route 78, Section E. C. G. Willis & Sons, Inc. and Chas. G. Willis, Los Angeles, \$33,106; V. R. Dennis Construction Co., San Diego, \$38,252; J. E. Haddock, Ltd., Pasadena, \$38,721; Chas. H. Johnston, Los Angeles, \$39,387; R. E. Hazard & Sons, San Diego, \$39,783; A. S. Vinnell Co., Alhambra, \$40,162; Daley Corp., San Diego, \$41,496; Byerts & Dunn, Los Angeles, \$50,653.

Contract awarded to Roland T. Reynolds, Anaheim, \$29,918.

SAN JOAQUIN COUNTY—At Stockton State Hospital, 0.1 mile to be graded and surfaced with plant-mixed surfacing on crusher run base. District X, Stockton State Hospital, Lee J. Immel, Berkeley, \$7,320; Johnston Rock Co., Inc., Stockton, \$6,231; M. J. B. Construction Co., Stockton, \$6,303; S. M. McGaw, Stockton, \$6,197. Contract awarded to Louis Biasotti & Son, Stockton, \$5,688.

SANTA BARBARA COUNTY—Between Tecolote Creek and Las Varas Creek, about 3.4 miles to be graded and surfaced with plant-mixed surfacing. District V, Route 2, Section G. Maceo Construction Co., Clearwater, \$219,495; Gibbons & Reed Co., Burbank, \$221,384; Oswald Bros., Los Angeles, \$229,674; J. E. Haddock Ltd., Pasadena, \$235,612; R. E. Hazard & Sons, San Diego, \$238,833; Fredericksen and Westbrook, Sacramento, \$240,626; A. Teichert & Son, Inc., Sacramento, \$248,090. Contract awarded to Basich Brothers, Torrance, \$216,772.

SISKIYOU COUNTY—Between Weed and 1.4 miles north, about 1.4 miles in length, to be graded and surfaced with road-mix surfacing on crusher run base. District II, Route 72, Section A. Fredrickson Bros., Emeryville, \$65,506; Fredericksen and Westbrook, Sacramento, \$67,790; A. Teichert & Son, Inc., Sacramento, \$72,288; Poulos & McEwen, Sacramento, \$73,744. Contract awarded to Parish Bros., Hollywood, \$65,442.

SONOMA COUNTY—Between 2.3 miles north and 1.2 miles south of Petaluma about 3.6 miles to be graded and surfaced with asphalt concrete and a reinforced concrete bridge to be constructed. District IV, Route 1, Section C. Pet. Heafy-Moore Co. and Fredrickson & Watson Construction Co., Oakland, \$207,835; A. Teichert & Sons, Inc., Sacramento, \$209,468; Fredericksen and Westbrook, Sacramento, \$211,447; Chas. L. Harney, San Francisco, \$215,587. Contract awarded to Louis Biasotti & Son & L. D. Tonn, Stockton, \$205,836.

TRINITY COUNTY—Between Douglas City and Vitzthum's, about 0.8 mile to be graded and surfaced with screened gravel base and surfacing material and embankment protection to be constructed. District II, Route 20, Section A. Claude C. Wood, Lodi, \$109,917; Harms Bros. & N. M. Ball Sons, Berkeley, \$127,853; C. W. Caletti & Co., San Rafael, \$139,554; Johnston Rock Co., Inc., Stockton, \$156,316. Contract awarded to Hemstreet & Bell, Marysville, \$106,307.

YOLO COUNTY—Between one mile east of Davis Subway and Swingle, about 3.5 miles to be graded, portland cement concrete pavement to be constructed and the existing pavement to be surfaced with plant-mixed surfacing. District III, Route 6, Section A. N. M. Ball Sons, Berkeley, \$177,971; A. Teichert & Son, Inc., Sacramento, \$181,877; M. J. B. Construction Co. and F. Kaus, Stockton, \$188,646; Henfey-Moore Co. & Fredericksen & Watson Construction Co., Oakland, \$206,666. Contract awarded to Fredericksen & Westbrook, Sacramento, \$172,955.

Clerk: "Sir, my wife is cleaning house and wants me to help her. Would you let me off this afternoon?"

Manager: "I certainly will not."

Clerk: "Thank you, sir. I knew I could count on you."—The Live Oak.

State of California

CULBERT L. OLSON, Governor

Department of Public Works

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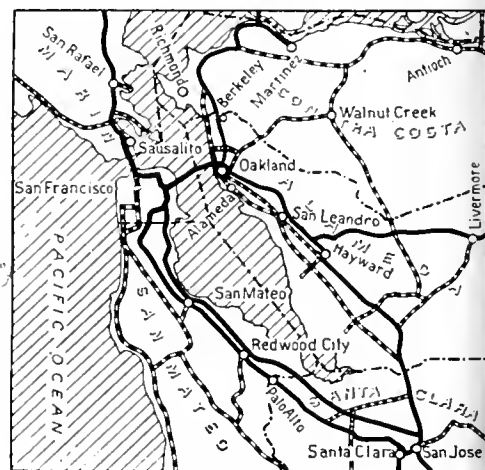


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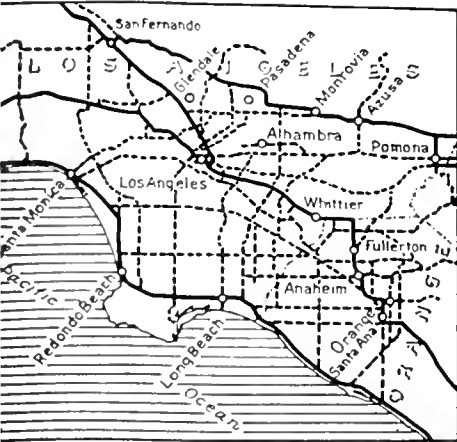
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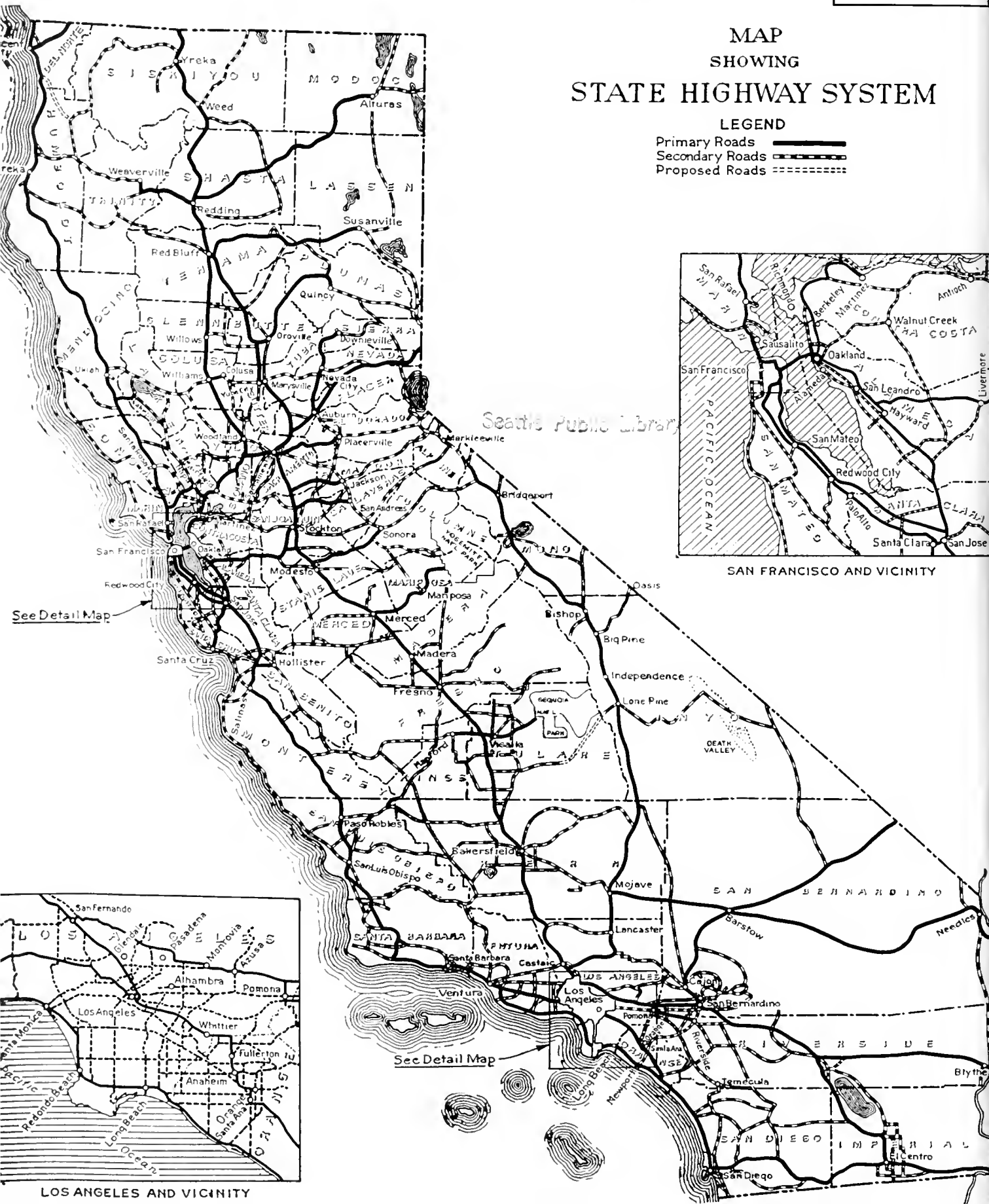
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SAN FRANCISCO AND VICINITY

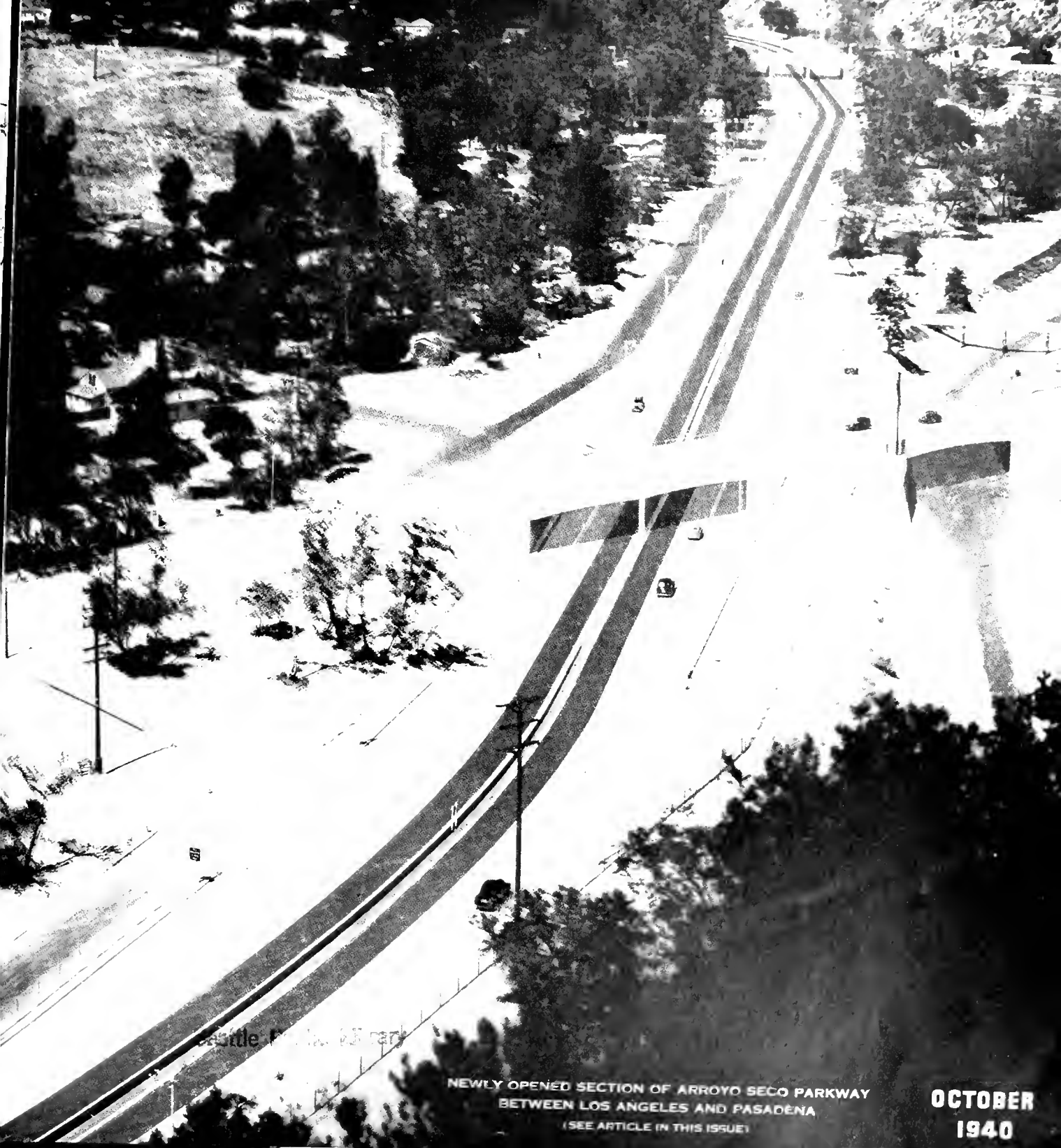


LOS ANGELES AND VICINITY



CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



NEWLY OPENED SECTION OF ARROYO SECO PARKWAY
BETWEEN LOS ANGELES AND PASADENA
(SEE ARTICLE IN THIS ISSUE)

OCTOBER
1940

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California

FRANK W. CLARK, Director

C. H. PURCELL, State Highway Engineer

J. W. HOWE, Editor

K. C. ADAMS, Associate Editor

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Vol. 18

OCTOBER, 1940

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State Adopts A Three Point Program for Marketing Power Of the Central Valley Project

A THREE-POINT program of State assistance to the Federal Government in the development of a public market for Central Valley Project electric energy was approved by the Water Project Authority of California in a meeting held in Sacramento September 8th with United States Commissioner of Reclamation John C. Page and other representatives of the Federal Government.

The program the Water Project Authority is undertaking in behalf of the Federal Government includes:

1. Preparation of a comprehensive engineering report on the means and methods of disposal of Central Valley Project power.
2. Assistance in the formation of public districts in areas desiring to purchase this power.
3. Assistance to public agencies in determining methods of financing for public distribution of power.

GOVERNMENT CONTRACT NECESSARY

Commissioner Page, who approved the program, declared that a working agreement or contract would have to be drawn up between the Authority and the Federal Government covering work to be undertaken by the State.

At the same time the Authority authorized a letter to the legislature which will convene in January asking for the appointment of a special committee of both houses to work with the Authority in framing legislation needed for the adequate financing of public agencies desiring to distribute Central Valley Project power.

The Authority, at the suggestion of Chairman Frank W. Clark, also went on record favoring a conference with Federal officials and representatives of the Pacific Gas & Electric Company concerning utilization of existing facilities for the distribution of Shasta power.

"In making any change from private distribution of power to a program of public ownership," Chairman Clark said, "our first consideration must be the public and to secure for it

Power Value Scale

Value of Shasta Dam electric power delivered to city gates as set up by U. S. Department of Interior is shown in the following table:

Unit Values—Mills per Kilowatt-Hour

	Pumping hydro only	Service to Public customers hydro and steam
For Government delivery to load centers:		
Firm -----	3.90	5.18
Dump -----	---	1.77
Average -----	---	4.70
For Government delivery to Antioch:		
Firm -----	---	4.28
Dump -----	---	1.46
Average -----	---	3.88
For Government delivery at Shasta:		
Firm -----	---	2.98
Dump -----	---	1.02
Average -----	---	2.71

the fullest benefits and advantages of public ownership. The present administration is, and will be, unalterably for the public generation and distribution of Central Valley Project power. However, I believe we should exhaust every possibility in preparing for this change to prevent economic waste through unneeded duplication of facilities and I have therefore suggested this conference between the Water Project Authority, the Federal Government and the Pacific Gas & Electric Company.

"It is Governor Olson's belief, in which I share, that part of the necessary facilities to deliver Central Valley Project power to the people can be utilized for a proper and fair consideration, thus preventing the eco-

nomie waste of unnecessary duplication and at the same time protecting the existing utility against confiscation."

State Engineer Edward Hyatt, as executive officer of the Authority, was instructed to consult with engineers of the company concerning existing facilities of the utility.

Commenting on the proposed work program outlined by the State, Commissioner Page declared:

"I think a great amount of good will result if the Authority steps out aggressively and lets the people know that it is now in a position to give assistance to districts desiring Central Valley Project power. This move will grow like a snowball rolling down hill and then I am sure you will have no trouble in getting legislation you need for proper financing of these districts.

"I was decidedly pessimistic when I came to this conference as to the manner in which the Authority could function as a real asset to the government and the development of the Central Valley Project.

PAGE IS OPTIMISTIC

"Now I am decidedly optimistic that something can be accomplished—again stressing the fact that we are partners and a team—both of us trying to get for the State of California the maximum benefits from the tremendous undertaking on which we are now engaged."

At the September 24th meeting of the Authority the Glenn-Colusa Irrigation District, the largest irrigation district in the Sacramento Valley, submitted a request for information and assistance concerning the possibility of the district acting as a purchaser and distributor of Central Valley Project power for a large area on the west side of the Sacramento Valley.

Chairman Clark, speaking in behalf of the Authority, declared that every possible assistance would be given not only to the Glenn-Colusa Irrigation District but to all districts and areas



FRANK W. CLARK
Chairman, California Water Authority

interested in acquiring Central Valley electric energy for public distribution.

On motion by Attorney General Earl Warren, the Authority unanimously went on record instructing the executive officer to confer with and assist and encourage all areas that have indicated a desire to utilize the power from Shasta Dam. The assistance to be given will include engineering and legal aid as required.

The Glenn-Colusa Irrigation District is the largest in the Sacramento Valley, serving an area of 122,000 acres and pumping water for several other irrigation districts. In addition to its own territory the irrigation district outlined a plan to serve outlying areas extending from the Glenn-Tehama County line south to Arbuckle. Representatives of the district said the area would include half a dozen small cities and approximately 15,000 consumers of electric energy.

P. J. Minasian, attorney for the district, told the Authority his directors were particularly interested in the possibilities offered through the issuance of revenue bonds for the purpose of financing distribution lines and asked for information on marketing of such bonds.

E. Wayne Miller, attorney for the

Maxwell and Arbuckle Municipal Utility Districts, and N. C. Steele, mayor of Colusa, informed the Authority their cities would come within the scope of the Glenn-Colusa proposal and asked that they too be given assistance by the Authority in obtaining Central Valley Project power through public facilities.

Miller sharply criticized existing power rates paid by the farmers to the private utility serving the area and stressed the need for immediate action on the part of the Authority or the Federal government in setting up machinery by which areas desiring Shasta Dam power could place themselves in a position to purchase it.

"If we are going to get power and if we are going to get our power costs down," said Miller, "we feel this is our golden opportunity where we have a new source of power to be distributed. If proper machinery is provided we won't have to wait until the transmission line is completed down through our district to find the ways and means for distribution of power which in itself would probably take several years to complete."

OTHER DISTRICTS APPLY

Other districts which have requested assistance or information on acquiring Central Valley power for public distribution are the Sacramento Municipal Utility District, Banta-Carbona Irrigation District, East Contra Costa Irrigation District, Byron-Bethany Irrigation District, West Side Irrigation District, Juaquina-Packwood Canal area, Tulare Central Counties Utility District and the cities of Redding, Chico, Roseville and Lodi.

In connection with these numerous requests for information on Central Valley Project power the Water Project Authority held a preliminary meeting with representatives of the United States Bureau of Reclamation and the Department of Interior in San Francisco August 28th and 29th.

Previous to the meeting with Commissioner Page the Authority had instructed its legal staff to make a study of the adequacy of existing district acts to determine whether the various districts were properly empowered to take advantage of the water and power to be developed by the Central Valley Project.

The legal staff was also instructed



EDWARD HYATT
State Engineer

to prepare an opinion for the Authority on Section 18 of the Central Valley Project Act which has to do with the issuance of revenue bonds. The construction of the section is not clear and two attempts to have this fault in the act clarified by the Legislature have failed. Until the section is clarified either by legislation or through the courts the Authority can not issue revenue bonds which would be salable.

Another highly important development was the presentation of a paper by State Engineer Edward Hyatt, executive officer of the Authority, on the power prospects of the Central Valley Project at a meeting at Shasta Dam on October 3d of the Central Valley and Central Coastal Basin divisions of the National Resources Planning Board which acts in an advisory capacity to President Roosevelt.

MARKET FOR TOTAL POWER

The paper outlined the power production possibilities of Shasta Dam, the market and possible methods of disposal, the cities or districts which now own and operate their own sys-

Shasta Dam picture on the adjoining page shows impressive progress made in construction of huge blocks of concrete on the site of the East abutment of the dam.

U. S. Bureau Photo



tens or generate their own power and those in the process of formation. The paper concluded:

"There is no question as to the ability of the market to absorb the entire power output that can be made available and it may confidently be expected that disposal will be effected by one or the other, or a combination of the methods of disposal described.

"According to recently announced expectations of the Bureau of Reclamation, Shasta power will be available in 1945. If this power is to be utilized through the medium of publicly owned electric utility systems in conformity with the preference granted by both Federal and State law, public agencies must be organized and preparations made without delay so that the necessary electric facilities required for such wholesale disposal of power from the project can be planned and constructed and so that local distributing systems can be provided, by the time the power becomes available."

Jean Vincenz, Director of Public Works of Fresno, discussed the paper for the group and pointed out the difficulties which are encountered by public agencies in acquiring distribution systems.

Regional Director E. W. Kramer, of the Federal Power Commission, told the board that all present estimates of power consumption in California covering the next three years would have to be revised upward because of the increases caused by the national defense program.

To be properly integrated with market demands and the program for meeting those demands, Kramer declared that Shasta Dam power should be made available in 1943 when it is estimated present and planned capacities for generation of power other than Shasta Dam will be absorbed.

Announcement of the probable value of Central Valley Project power by R. V. L. Wright, special representative of the U. S. Department of Interior, marked the high point in the conference between members of the Water Project Authority of California and representatives of the Bureau of Reclamation, which was held in San Francisco, August 28th and 29th.

The value of electric power delivered to city gates, the Federal stud-

ies showed would be 5.18 mills per kilowatt hour for firm power.

State Director of Public Works Frank W. Clark, as chairman of the Water Project Authority, declared he was gratified with the information the Federal Government had presented.

"In spite of the fact that these figures are only preliminary," Clark said, "we are now in a position to tell the people of California the value of power available from the Central Valley Project if they take the necessary steps to buy it.

"This, however, is going to necessitate the forming of proper districts and while the Water Project Authority of California is willing and ready to cooperate with areas wishing to form these districts by furnishing assistance and engineering information, it can not go beyond that point at this time.

"Bureau representatives told the Water Project Authority quite specifically that it was the intention of the Federal Government to build and operate the project. Mr. Wright said that the government would also assist in the forming of districts for the public distribution of Central Valley Project power. To date, Mr. Wright said, nothing has been done by the Federal authorities in promoting these districts.

"The Water Project Authority through its staff is in a position to do this work. The figure of 5.18 mills for firm power will be available only to the agencies which have been properly organized and are in a position to make a bid for this power. That is where the greatest bottleneck will occur. Power will be available in the spring of 1945, which gives unorganized districts contemplating the public distribution of Shasta Dam power all too little time to organize even if they begin work at once.

"Our duty on the Water Project Authority is to inform the public of this situation and if possible arouse them to action so they will be in a position to participate in the benefits of cheaper power rates."

Numerous other issues concerning the future of the Central Valley Project were clarified during the discussions which ranged from the history of the origination of the project by the State, through the financing and present construction period on to future policies and possibilities.

In addition to presenting a prelim-

inary estimate of the probable value of Shasta Dam power, other important discussions covered:

Clarification of the part the Federal Government expects to play in the construction and future operation of the Central Valley Project.

Delineation of the cooperative field in which the Water Project Authority of California will function.

Plans for continued conferences between the State and Federal Government on an interim contract and the exchange of engineering data on possible methods of operation of the project.

WATER AUTHORITY'S POSITION

In a formal statement at the opening of the conference, Mr. Clark, as chairman of the Water Project Authority, summed up the authority's position in regard to the Central Valley Project as follows:

"It is essential that the proper respective functions, duties and responsibilities of the authority and the United States relative to the construction, operation and management of the project should be defined.

"We want to know, first, the price, kind and quantity of the commodity we are asked to sell, and second, what authority we are to have in disposing of it. We can not provide buyers before we are put in a position to give them the answers to these questions."

Replying, Mr. Wright quoted from a letter written to Governor Olson by Secretary of the Interior Harold L. Ickes, in which he said:

ICKES' LETTER TO GOVERNOR

"In the sale of Central Valley power, the State, or an agency of the State acting in the interests of a group of public agencies having power outlets, would, under suitable conditions, be admirably qualified to receive the preference given by the law. The State of California, I feel, has a responsibility in connection with the Central Valley Project. This responsibility, in part at least, might be discharged by the State's making itself ready to act as a power distributor or ready to act in the interests of public power distributors. The interest of the Department of Interior is to gain the widest possible public benefits from the project, and if it furthered this interest, I would be glad to make a contract with the State or a proper author-

ity of the State for disposal of Central Valley power.

"I have encouraged and will continue to encourage the State to help us in this manner."

Specifically Mr. Wright asked the Water Project Authority to outline for presentation to the Secretary of the Interior a definite plan by the State of what it can do in the way of organizing and financing public districts for the distribution of Central Valley Project power.

PLAN FOR STATE ACTION

"Based on such information as the State may care to submit to us," Wright said, "we hope to be able to convey to the Secretary of the Interior our opinion as to the readiness, ability and willingness of the State to aid the development of this project in the matter of the sale and distribution of power. It would seem appropriate at this point to outline the information we would consider conclusive as to the feasibility of a plan submitted by the State.

"These showings should set forth marketing commitments from responsible purchasers of power; evidence of legal authority for and plans to finance and operate the public power system or systems proposed by the State; a statement of resale rates at which Shasta energy is to be sold to the public; a proforma statement of earnings and expense; and, finally, a request for an allotment of power which may be definitely acted upon by the Secretary and, if considered in the public interest, result in an agreement with the authority.

"I think it is up to your Authority and the Federal government," Wright said, "to pursue the exploration of what the State can and will do as rapidly as possible, so that as of March, 1945, when the power is available for distribution somebody will have done the job, whether it is you or somebody else."

In presenting the preliminary power values, Bureau of Reclamation engineers estimated there would be 834,000,000 kilowatt hours a year of firm power available for commercial sale from the Shasta Dam hydro-electric plant and that construction of a 109,000 kilowatt capacity steam plant at Antioch would be necessary. With the steam plant there would be 1,083,000,000 kilowatt hours of firm power a year available for commercial sale

(Continued on page 19)



At top—First water from Central Valley Project pumped through Contra Costa Canal for use of Pittsburg City. Bottom—Contra Costa Canal. Lift pumping plant in background

Proposed Arroyo Seco Parkway Extension to Los Angeles Business Center Through Elysian Park

By A. D. GRIFFIN, District Office Engineer, District VII

IN AND around the metropolitan Los Angeles area it is almost a foregone conclusion that when a new improved highway facility is opened to the public so large a volume of traffic is attracted to it that the adjoining sections of this highway which have not already been adequately improved become badly over-taxed. We are certain to face this situation when the Arroyo Seco Park-

22 southerly along North Figueroa Street, in order to relieve the bad traffic congestion across the Los Angeles River Bridge, through the Riverside Drive intersection, and in the four Elysian Park tunnels where even now during the morning and evening rush hours the traffic delays are intolerable?"

Existing traffic congestion on North

Street and Avenue 22 for northbound traffic only.

2. Construct additional four-lane bridge across the Los Angeles River upstream from existing bridge, the grade of the southerly end of the bridge to be above Riverside Drive, permitting northbound Riverside Drive traffic to turn left under the new bridge.
3. Construct a four-lane roadway, in



Map of Proposed Southerly Extension of Arroyo Seco Parkway into Los Angeles Business District

way is completed, particularly from the southerly terminus at Avenue 22 into the business district of Los Angeles city.

Los Angeles city and county traffic authorities, and the general public who will use the Arroyo Seco Parkway between Los Angeles and Pasadena after it is completed, are even now asking the question:

"What does the State propose to do in Los Angeles city from Avenue

Figueroa Street is shown by recent photographs accompanying this article. It is not difficult to imagine what will happen when the Arroyo Seco Parkway is opened to traffic before the proposed increased facilities to the south have been completed.

The general plan developed by the State for handling this situation is—

1. Use the four existing tunnels, roadway and bridge over Los Angeles River between Castelar

open cuts if possible, for southbound traffic on the westerly side of existing tunnels and at a higher elevation to facilitate grade separations for traffic at Solano Avenue, Bishops Road and at Castelar Street.

4. The new work on Figueroa Street from Avenue 22 to Adobe Street to be on a freeway basis.

At the time the city of Los Angeles built the existing tunnels they ex-



North Figueroa Street Bridge over Los Angeles River showing effect of traffic making left turn for Riverside Drive



Traffic through North Figueroa Street tunnels meets cross traffic at Solano Street intersection



At top and bottom—Views looking southerly along Castelar Street showing interference of late afternoon traffic on North Figueroa Street by reason of southbound traffic on Figueroa Street making left turn into Castelar Street. This condition will be eliminated by a grade separation on proposed extension route

pected, when traffic developed sufficiently to require it, to construct a parallel line of tunnels. A recent estimate by the city for an additional four-lane bridge across the Los Angeles River and the additional line of tunnels and four-lane roadway from Avenue 22 to Adobe Street was given out as \$2,500,000.

By reason of the fact that considerable PWA and WPA Federal funds became available for the Arroyo Seco Parkway construction which were not anticipated when the highway budget was adopted, savings have resulted in

the State budgeted funds. The California Highway Commission made these savings available for starting work on the Arroyo Seco Parkway Southerly Extension through Elysian Park leading into downtown Los Angeles.

A study was made to determine the possibility of substituting open-cut construction for the roadway through the Elysian Park Hills instead of tunnel construction. Roadways in open-cuts are preferable to tunnels because of greater safety and efficiency in vehicular operation, and also because of

greater possibilities for beautification and landscaping. This study of "open-cut versus tunneling" immediately raised the question of stability of the cut slopes and involved us in geological considerations.

District Materials Engineer R. J. Allan, who has had considerable training and experience in geological and mining studies and investigations, made an extensive geological survey of this portion of the Elysian Park area through which the North Figueroa Street tunnels have been constructed. The studies conducted



by Mr. Allan were for the purpose of answering questions as follows:

1. If open cuts are constructed instead of tunnels, what cut slopes should be used in order to be assured of safety from future landslides?
2. What would be the effect of eccentric loading on the existing tunnels due to open cut construction nearby?
3. What would be the closest distance from existing tunnels that open cuts could be constructed without danger of damage to the existing tunnels?
4. What would be the future possibility of damage due to earthquake action?

Some years ago a large landslide occurred in Elysian Park, only one-fourth mile distant from the northerly portal of the North Figueroa Street Tunnel near the Riverside Drive connection and city authorities were fearful of possible damage to the tunnels because of landslide conditions. Dr. John P. Buwalda, eminent geologist of California Institute of Technology, was engaged to make a geological study by the city to determine safety of existing tunnels.

Because of Dr. Buwalda's familiarity with this vicinity, the State engaged him as a Consulting Geologist in regard to feasibility and safety of the district's plans for open-cuts instead of tunnels for the contemplated Arroyo Seco Parkway Extension southerly through the Elysian Park Hills. It was most gratifying to find that Dr. Buwalda's investigations and report gave full approval of our plans. Geological reports are not always "dry as dust" although they largely deal with ancient happenings and certain sections of Dr. Buwalda's geological report of August 21, 1940, which will be of interest to readers of this article, are being quoted:

"GEOLOGY—The rocks of the North Figueroa Street tunnel area belong to the Puente formation, which is of Miocene age. The materials were laid down in the sea as sands and muds some 12 millions of years ago and, buried beneath thousands of feet of younger sediments, they became compacted to strata of sandstone and shale. They



View through three Figueroa Street tunnels under Elysian Park

were further solidified by the deposition of calcium carbonate in the pore spaces, cementing the constituent particles together. The sandstones are hence harder than very young sedimentary formations or soils, but softer and less strong than granite.

"In any region in which the strata have been tilted to angles of 30 or 45 degrees, minor faults develop in response to the inequality of relief afforded by the harder and softer parts of the formation. Such faults are seldom long and aside from shattering the rock somewhat locally they are not important. A number of such minor fractures are

exposed in the tunnel district but they are not seriously detrimental to engineering operations. No major faults pass through or near the Figueroa Tunnels.

"In some parts of southern California the rocks are so severely jointed as to make construction operations very difficult. The strata in the Figueroa Street tunnel district are only normally jointed and shattered rock is uncommon.

"The direction of the tunnels is such that they cross the moderately dipping strata at a large angle, which is a much more fortunate re-

(Continued on page 14)

East Shore Highway Project Wins Assurance of Highway Commission

FURTHER development in California of the freeway type of highway construction became assured when the Highway Commission at its meeting in Oakland on September 27th pledged itself to start building the proposed East Shore Highway between Oakland and San Jose next year.

The commission, through its chairman, Larry Barrett, promised to include in its next biennial budget funds to launch actual construction on the first unit of the project.

Already \$1,030,000 have been spent by the State and the city of Oakland jointly in the purchase of rights of way for the new highway from Fifth Avenue and Oak Streets in Oakland to Fiftieth Avenue, south of Fruitvale.

While the commission was unable to indicate the exact sum of money it would be able to allocate for the un-

dertaking, Mr. Barrett informed the Central California East Shore Highway Committee, the Oakland Chamber of Commerce and other civic groups that funds would be made available in the 1941-43 budget for a start on the project.

The East Shore Highway will be a six-lane divided freeway with separation structures at various important cross roads such as Fifth Avenue and Fruitvale Avenue.

A possible first unit would extend from Fifth and Oak streets to Thirty-fifth Avenue, and cost approximately \$2,000,000.

CITY AND STATE COOPERATE

From the $\frac{1}{4}$ -cent gas tax revenues for State highway construction within municipal limits the city of Oakland will have contributed about \$600,000 by the end of the present biennium for rights of way and the

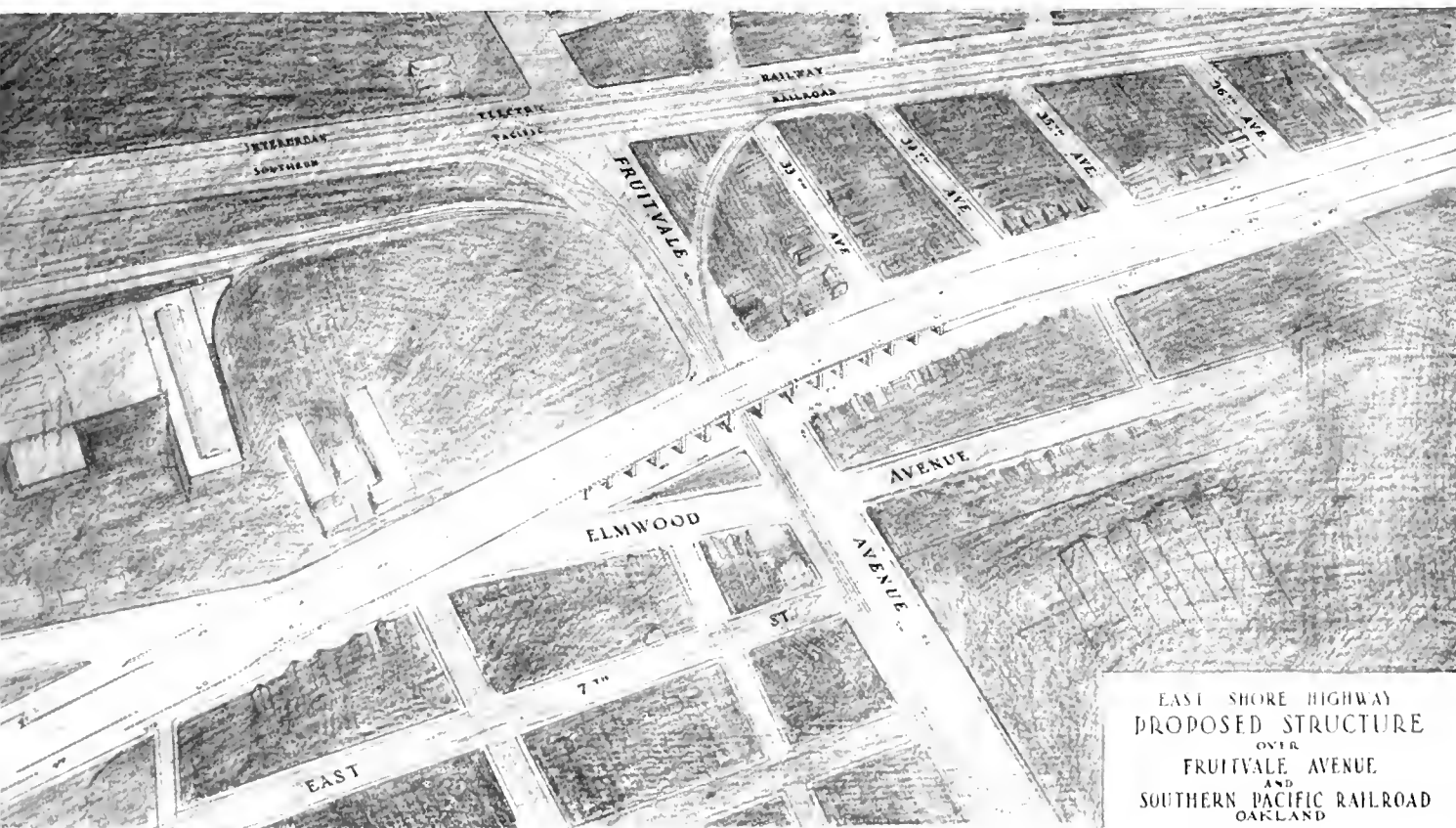
State's participation in the acquisition of rights of way will amount to \$430,000.

To a large delegation of citizens from Alameda, San Joaquin, Santa Clara and Monterey counties which was present at the Oakland meeting of the commission, Chairman Barrett said:

STATEMENT BY BARRETT

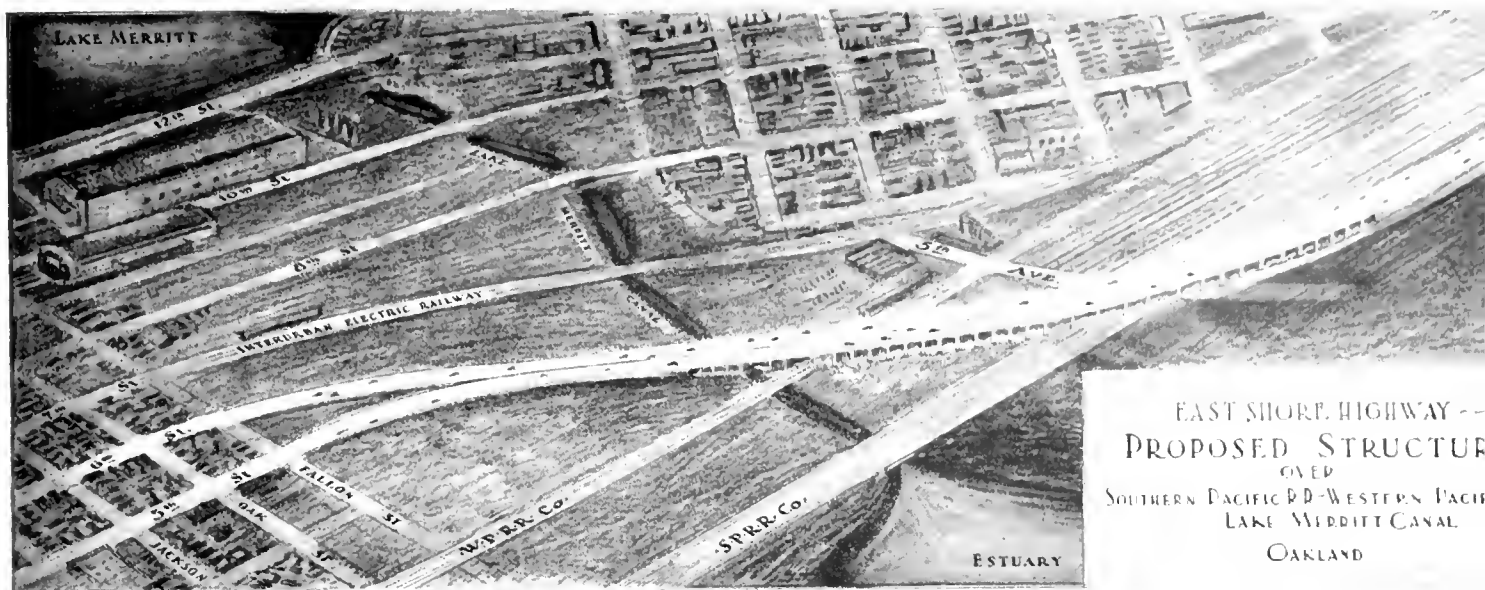
"The commission is in accord with your thoughts on this project and when we begin holding our budget sessions in Sacramento in October to prepare our next biennial budget, I am sure you will be pleased with the consideration we shall give to the East Shore Highway. We consider this project a very important job which should be undertaken immediately."

The design of the new freeway, as far as overhead structures and cross-



EAST SHORE HIGHWAY
PROPOSED STRUCTURE
OVER
FRUITVALE AVENUE
AND
SOUTHERN PACIFIC RAILROAD
OAKLAND

Sketch of proposed overhead structure for East Shore Highway traffic over Fruitvale Avenue and railroad tracks in Oakland



Proposed Divided Highway Structure for East Shore traffic over Lake Merritt Canal and railroad tracks in Oakland

ing separations are concerned, will be similar to that on the Arroyo Seco Parkway between Los Angeles and Pasadena, now nearing completion, and the design for the proposed Bay Shore Freeway between San Francisco and Palo Alto.

The East Shore Highway is designed to:

1. Provide adequate transportation between Oakland and valley points for agriculture and industrial needs.
2. Open a satisfactory trade route between Oakland and San Jose.
3. Provide an easier route to reach recreation areas.
4. Eliminate a defense bottleneck, opening routes to the Oakland Naval Supply Depot, the Alameda Naval Air Base, Sunnyvale and Hamilton Fields and Camp Ord.
5. Eliminate traffic congestion during such events as football games.

A report of a traffic check made last June on East 12th Street presented to the commission showed that 40,000 automobiles traveled that day on that four-lane street, which constitutes a traffic bottleneck.

Essentials for a good date garnered from a general survey of men around the campus:

1. She doesn't eat much.
2. She's good looking.
3. She doesn't eat much.
4. She's a good dancer.
5. She doesn't eat much.

—College Humor

September Traffic on Bay Bridge Sets an All-Time High Record

TRAFFIC on the San Francisco-Oakland Bay Bridge reached an all-time high record during September, a month of 30 days. Since the end of the month saw the close of the Treasure Island Exposition, it is probable that the September traffic figures will stand for some time.

The heaviest day of the month was on Sunday, September 29, when 75,149 vehicles were accounted for. Inasmuch as the traffic from Oakland to

the exposition and return had to be handled by the collectors three times, the total number of vehicles actually handled on that day amounted to 98,273.

September traffic on the San Francisco-Oakland Bay Bridge, the Carquinez and Antioch bridges is tabulated below. The figures for the Carquinez and Antioch bridges are for the period from 11 a.m., September 16, to the end of the month only.

	San Francisco-Oakland Bay Bridge	Carquinez Bridge	Antioch Bridge
Passenger autos and auto trailers	1,552,245	127,494	7,923
Motorcycles and tricars	4,874	463	20
Buses	31,084	2,151	92
Trucks and truck trailers	67,463	11,454	2,102
Others	22,303	67	12
Total vehicles	1,677,969	141,629	10,149

"FULL OF INFORMATION"

California Highways and Public Works,
P. O. Box 1499,
Sacramento, California.

Dear Sirs:

I am an employee of the United States Engineer Office, and your fine magazine sent to our office falls into my hands

first, before being passed around and eventually to our files. I find it so interesting and full of information about California's highways that I would like to be placed upon your mailing list.

Kindly send the publication to my home address.

Very truly yours,

R. J. BRUN,
1777 Vallejo Street,
San Francisco, California.



Rugged Point Mugu on the Coast Highway in Ventura County has had its point cut off by a safe modern highway

Highway Through Point Mugu

By G. R. HALTON, Resident Engineer

TEN miles southeasterly from Oxnard in Ventura County the terrain bordering the Coast Highway, which is designated as U. S. 101 Alternate (State Route 60), changes abruptly at Point Mugu from a tidal flat to an irregular, rocky, sharply sloping coast line which continues for approximately six miles, where it changes to alluvial bench land.

At Point Mugu the physical characteristics and the resultant problems of design and construction are most difficult. Approximately nineteen years ago work was begun at this point by day labor crews, who slowly prepared a route around the rocky cliffs and coves of the point. In 1923-24 a major highway construction contract extended the rough grading from Point Mugu to Little Sycamore Creek.

Additional grading and the construction of a two-lane portland cement concrete pavement were done by contract in 1928-29, and a third lane of pavement was added in 1933.

Meanwhile day labor shore protection work has been carried on continuously to the present time, with concrete sea wall construction beginning in 1928. Because shore defense work can be done only during low tides in calm weather, other work has necessarily been provided for the day labor crew, in order to hold it in readiness for emergency repairs.

These State forces, under Construction Superintendent M. L. Sullivan, have done considerable slope excavation for minor widening or for removing precarious material and have also done much slide cleanup work.

When alignment improvement was

planned at Point Mugu it was logical, therefore, that the work be done by the day labor construction crew already established and equipped at the site of the work.

The alignment standards of this early construction were far below those demanded by modern high speed traffic. The problem of improving this alignment was particularly difficult because of the necessity for using the existing road during the construction of any improvements. Comprehensive relocations were projected, but were not adaptable to stage construction which limited budget allocations made necessary.

The demand for an improved alignment at Point Mugu was indicated by the many serious and fatal accidents which occurred there, one accident resulting in three fatalities. Early in

1937 the studies of this rugged coast line had not indicated the complete ultimate location of the road, but it was obvious that whatever the relocation, approximately the same improvement at Point Mugu itself would hold. From the standpoints of traffic safety and of alignment the most urgent need was there. Therefore, in October, 1937, the work of grading a cut 200 feet in depth through the rocky ridge of the point was begun.

The contemplated design was for $\frac{3}{4}$:1 slopes in cut with a 60-foot road-bed on a curve of 2000 feet radius, replacing the old 275-foot radius curve around the point.

Adjacent fills were to be 80 feet wide and provision was made for future widening of the Point Mugu cut to 80 feet.

A total of 320,000 cubic yards of excavation was involved at Point Mugu alone and an additional 15,000 yards for adjacent sections. Changes during construction brought the total to 400,000 cubic yards. Contrary to most jobs this material was not all utilized for embankment purposes; it was not a balanced job. Heavy riprap was used to protect the ocean side of existing fill slopes or to protect concrete sea walls from undermining. Many thousands of cubic yards which were not of riprap grade were used to backfill wave washed fill slopes and to build up the ocean floor and beach in front of the walls. Approximately 40 per cent of the excavated material was placed in new roadway embankment, most of which was across the tidal lands northwesterly from Point Mugu.

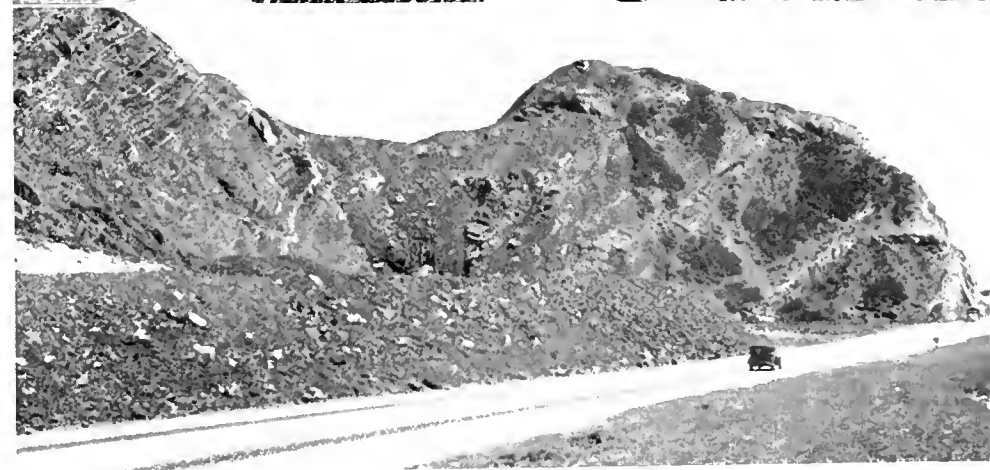
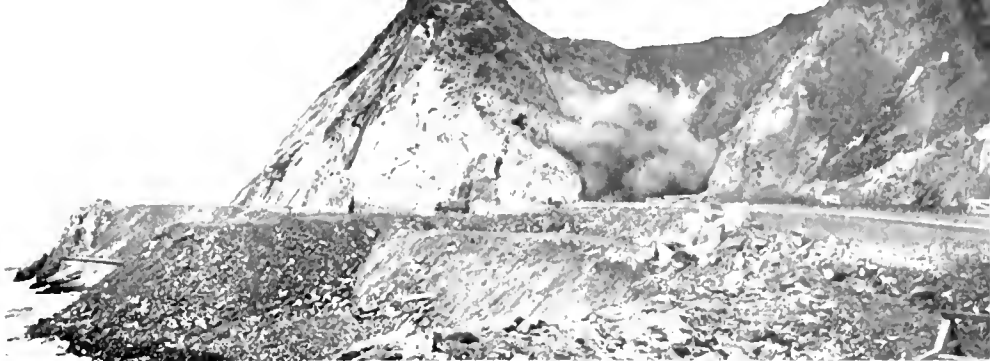
The cut was made by bulldozing the softer upper layers and by drilling and blasting the remainder from steep, full-section working faces.

Black powder in conjunction with stick dynamite was the principal explosive used but some 5 per cent granular blasting powder and a small quantity of 20 per cent bag dynamite were tried. An average of 0.537 of a pound of explosives was used for each cubic yard blasted, assuming 20 per cent of total displacement to have been mechanically made, without explosives.

Grading equipment consisted of a 1½-yard diesel shovel with from two to ten dump trucks, an angle dozer and RDS tractor, and two compressors and five jackhammers. Motor graders and a spreader box were used to lay the plant mix surfacing.

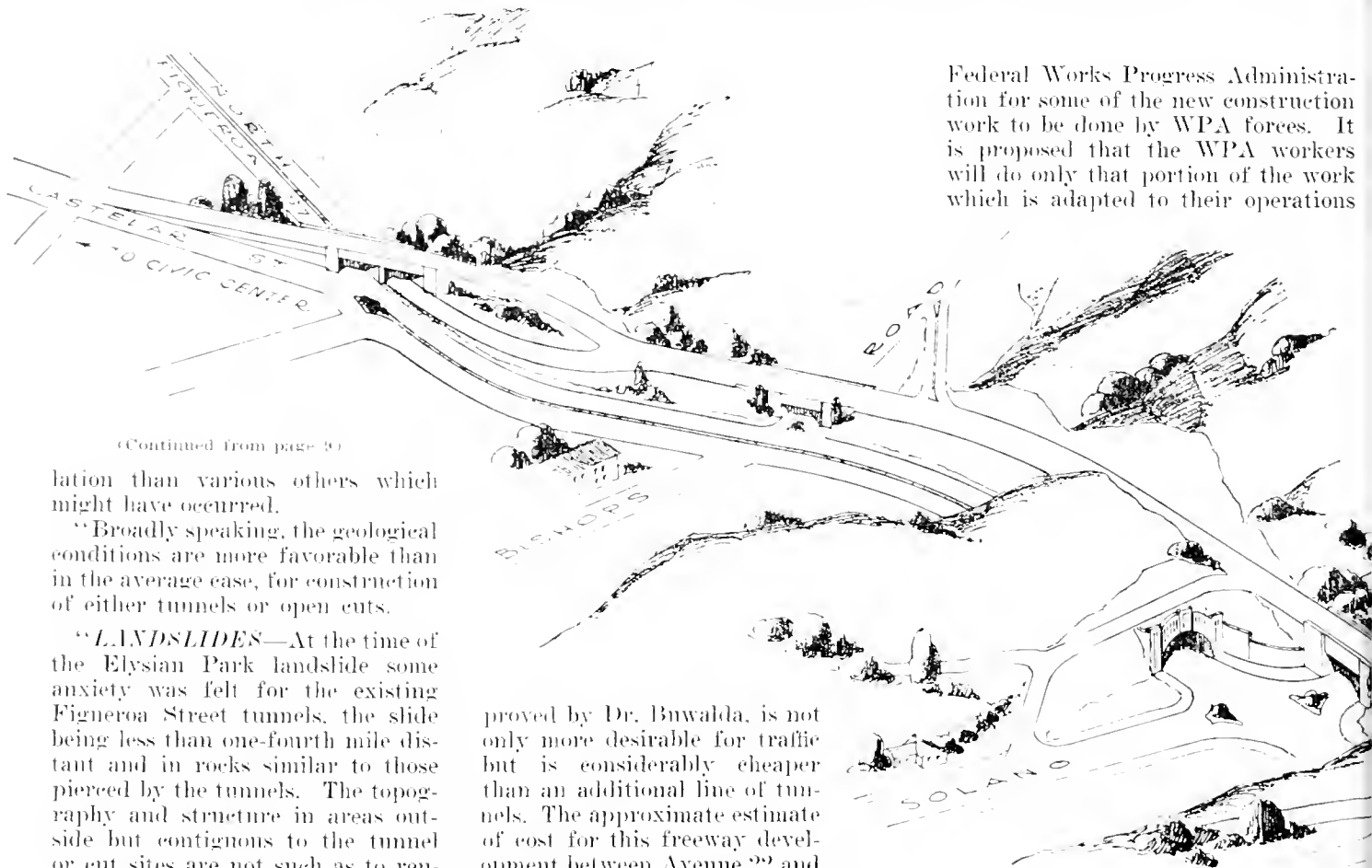
During the progress of the work it was decided to make connections with

(Continued on page 21)



Blasting and excavation scenes at cut through Point Mugu and old road around ocean end of mountain

Sketch of Proposed Arroyo Seco Parkway Extension



Federal Works Progress Administration for some of the new construction work to be done by WPA forces. It is proposed that the WPA workers will do only that portion of the work which is adapted to their operations

(Continued from page 9)

lation than various others which might have occurred.

"Broadly speaking, the geological conditions are more favorable than in the average case, for construction of either tunnels or open cuts.

"**LANDSLIDES**—At the time of the Elysian Park landslide some anxiety was felt for the existing Figueroa Street tunnels, the slide being less than one-fourth mile distant and in rocks similar to those pierced by the tunnels. The topography and structure in areas outside but contiguous to the tunnel or cut sites are not such as to render probable the development of landslides which might move into the cuts or destroy the tunnels, and it is believed that adoption of 1:1 slopes, with the exceptions noted, will prevent landsliding in the walls of the cuts.

"**EARTHQUAKES**—California is an earthquake region and it is certain, taking into account the recorded shock history of the State, that the tunnels and cuts will experience severe shaking during their lifetime. If tunnels are built earthquake accelerations should be taken into account in the design and construction. It is believed that 1:1 slopes, with exceptions mentioned, will be stable in an earthquake of the magnitude and intensity of the San Francisco earthquake of 1906, which is probably as strong a shock as it is economically practicable to guard against.

The open cut construction, the safety and stability of which was ap-

proved by Dr. Buwalda, is not only more desirable for traffic but is considerably cheaper than an additional line of tunnels. The approximate estimate of cost for this freeway development between Avenue 22 and Adobe Street on the basis of open cuts instead of tunnels, is \$1,500,000, based on some WPA assistance as hereinafter outlined. City of Los Angeles officials concur in this solution of the problem of creating a freeway extension for the Arroyo Seco Parkway. Although plan preparation is barely started and design details still have to be worked out, the general scheme for Arroyo Seco Parkway Southerly Extension through Elysian Park is shown on the perspective sketch accompanying this article.

The Federal authorities, realizing that many WPA projects in this vicinity are drawing to a close, are very anxious to have other important public work available to utilize workers from the large reservoir of unemployed in the metropolitan Los Angeles area. There are certain portions of the work on the proposed Southerly Extension of the Arroyo Seco Parkway on which these WPA workers can be used advantageously.

Mr. Frank W. Clark, Director of Public Works, has arranged with the

such as right of way clearing, reconstructing of Elysian Park facilities, carrying out roadway grading, constructing retaining walls and other related work.

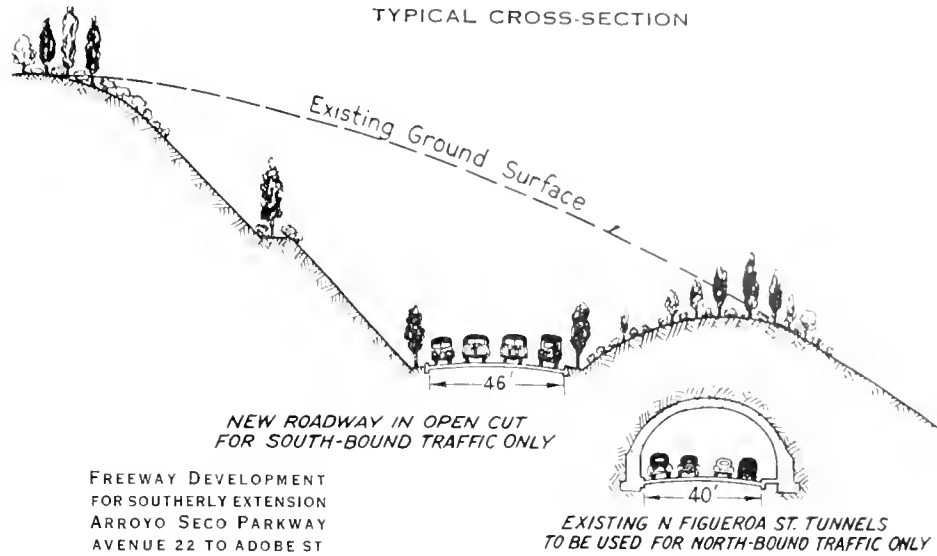
The substructure for the proposed new bridge on the Los Angeles River to carry southbound traffic is also work that will be handled by the WPA forces. It is then proposed that the new Los Angeles River bridge superstructure and also the necessary bridge structures at Castelar Street, Bishop's Road, Park Row and Solano Avenue, which require intricate specialized work not appropriate for WPA operations, be constructed by advertising and letting State contracts in the usual way.

While much preliminary work has already been done this is a project which requires many intricate designs for storm drains, sewers, retaining walls, and bridge structures, and it will be several months before all

Through Elysian Park to Los Angeles Civic Center

plans can be completed for the Arroyo Seco Parkway Southerly Extension between Avenue 22 and Adobe Street, which is 1.5 miles in length. But during the interval while detailed plans are being prepared, it is proposed that certain of the construction work be carried out immediately by WPA day-labor operations on those portions of the project for which plans can be turned out quickly.

A large force of men has already started on the WPA portion of the work, clearing for the new open cuts and carefully boxing and moving for later replanting, all valuable or de-

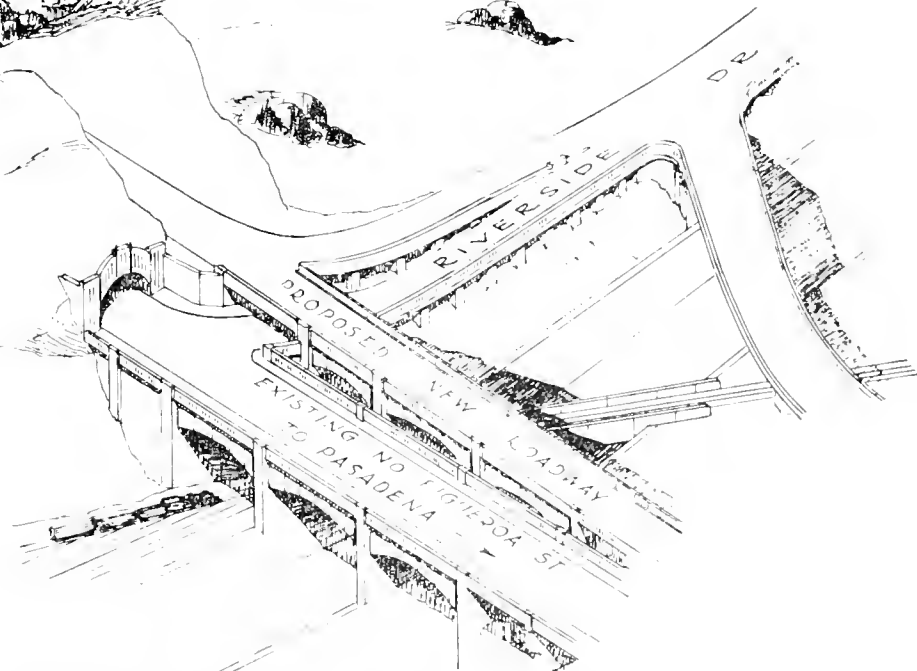


FREEWAY DEVELOPMENT FOR SOUTHERLY EXTENSION ARROYO SECO PARKWAY AVENUE 22 TO ADOBE ST

ELYSIAN PARK

sirable trees within the occupied Park area.

The remaining plan preparation will be vigorously pushed so that construction contracts can be advertised and awarded for the required bridge construction, to the end that all various essential items of construction work will be carried out expeditiously and that this southerly extension of Arroyo Seco Parkway will be made available for traffic as soon as possible.



Perspective Drawing by Humphreys

Relocation of Obsolete Section of U.S. 99 In Tehama County Underway

By F. W. HASELWOOD, District Engineer

THE improvement of six miles of the Pacific Highway in Tehama County from Red Bluff north is a continuation of the campaign to modernize this heavily traveled route. It is another attack on the few remaining stretches of 15-foot pavement on State highways. This six-mile improvement will replace a twenty-year-old highway that has seen traffic pass by in increasing volume, speed and weight until it has become obsolete to meet present requirements. The new road will embody the best that engineers now know in the matter of providing for a safe and free flow of traffic.

The road that in its day served well and faithfully its purpose now finds

itself with innumerable restrictions in sight distance, caused by sharp, horizontal or vertical curves or combinations of both, which restrict passing for long distances, impede the normal flow and cause congestion and hazards.

Nothing is static in highway affairs, particularly those relating to or affected by the increasing volume and changing behavior of traffic. Highway design must keep a jump ahead of these changes that affect it, even though highway finances seem never to be able even to keep up with them.

IMPROVING SIGHT DISTANCE

Therefore, new standards for safe highway alignment and grades have been set up, and we talk of highway

design in terms of sight distances, passing and non-passing, of the number of restrictions per mile and of free-flowing traffic. We talk of multi-lane and divided highways, but a first step in remedying the conditions that prevail on an obsolete highway with a pavement 15 feet wide is to provide the best two-lane highway permitted by the character of the country.

The relocation north of Red Bluff is through rolling country. The design provides for a free flow of traffic at all points at the present legal speed and with one short exception, at speeds of 60 miles per hour. To cross a low, broad ridge beginning about a mile out of Red Bluff, the problem of securing the desired minimum sight



One of sharp curves eliminated by relocation of old section of U. S. 99 north of Red Bluff in Tehama County



Top and center—Views of dumping and rolling cement stabilized base material on prepared subgrade of relocation north of Red Bluff
Bottom—Operation of applying curing seal of asphaltic emulsion on prepared subbase



Finished base ready for second course of plant-mixed, machine-spread asphaltic concrete

distance of 2200 feet offered a severe challenge and was finally solved by the use of a vertical curve 8000 feet long. Until challenged by a longer one, this vertical curve will claim the record for length of any such curve on any highway.

CHANNEL CHANGE INVOLVED

For nearly half its length, the highway relocation encroaches on the channel of Blue Tent Creek. This is one of those creeks that has a broad, gravelly bed, from 200 to 500 feet wide, and a small flow in normal winters that meanders back and forth in a poorly defined channel and an infrequent flow that sometimes covers almost the entire stream bed.

To provide assurance that this flow would not disturb the highway which occupied portions of the old stream bed, a channel change 2.5 miles long was made about 250 feet away from the road. Since material excavated from the cuts was of poor quality, the gravel removed from the channel change played an important part in the design of the road surface.

The absence of anything static in road design applies to surfaces as well

as other features. For several years, field experiments have been made with the use of portland cement as a stabilizer for the material composing the pavement base. On this project, another step has been taken toward the development of a lower cost but still substantial and durable surface suitable for heavy, main-line traffic.

CEMENT STABILIZED BASE

Gravel from the channel change was spread over the entire width of grade to a compacted depth of six inches. Additional gravel from the stream bed was crushed to one inch maximum size and mixed in a large concrete mixer that handles 8000 pounds at one time, with 6 per cent of cement and sufficient water to provide the optimum moisture for maximum compaction.

This mixture was spread on the road to a width of 24 feet and to a compacted depth of six inches. This layer was rolled with a 12-ton, three-wheeled roller, leveled with a blade and lightly sprinkled during rolling, finished with a rubber-tired roller and covered with a fifth of a gallon of asphaltic emulsion to a square yard to

prevent evaporation during the curing period. The result is a combination that looks and acts like concrete. The first seven-day test showed a compressive strength of 1245 pounds per square inch.

Over this stabilized gravel base will be placed a plant-mixed, machine-spread layer of bituminous mix three inches thick and 22 feet wide. Bituminous-mixed shoulders will be five feet wide on each side. The asphalt used will have a penetration of from 71 to 100. Mineral aggregate will be produced from gravel from the stream bed of Blue Tent Creek, which will be crushed and segregated into three sizes before being combined.

In some respects conditions were ideal for this type of surface. An inexhaustible supply of gravel was available at the middle of the job. It was of such size that crushing to a maximum size of 1 inch for the stabilized base and $\frac{1}{2}$ inch for the bituminous mix was not expensive. These sizes contributed much to the workability of the mixes. The 6 inch by 24 foot cement-stabilized base will cost about \$6,550 per mile, and the bituminous top will cost \$5,550 per mile.

Walter T. Ballou New Secretary Of Highway Commission

TRANSFERRED by Governor Culbert L. Olson to a larger field of public service, Walter T. Ballou, the Governor's assistant executive secretary, assumed the office of secretary to the California Highway Commission on October 1, succeeding Walter Chambers, who resigned.

Because of his familiarity with the State Highway System Mr. Ballou is considered by Governor Olson to be ideally equipped for his new position. He is well acquainted with the many problems confronting the highway Commission and has a wide knowledge of the road needs of every county in the State.

Mr. Ballou has been in State service since February, 1939, when he was appointed Deputy Director of the Department of Motor Vehicles. He was transferred from this office in April, 1939, to the State Relief Administration where he acted as Director of Personnel until August, 1939, when he was appointed assistant executive secretary for the Governor. He served in that capacity until October 1 of this year, when he assumed the duties of Highway Commission secretary.

Coming to California in 1907, Mr. Ballou established himself in Los Angeles, where he actively engaged in the automotive industry for 25 years, successfully operating and managing manufacturing companies of his own which manufactured and distributed automotive instruments of his own invention in many parts of the world. For many years Mr. Ballou took an active part in civic and business affairs in Southern California.

Mr. Ballou's appointment was announced by Chairman Larry Barrett of the Highway Commission at a meeting of the Commission in Oakland on September 27. In selecting Mr. Ballou, Governor Olson said:

"Walter Ballou is entitled to this promotion and the duties of the office are perfectly suited to his abilities. The Highway Commission could not find a more faithful, a more honest or a more capable man for the position of secretary than Mr. Ballou. He deserves the confidence placed in him by all with whom he has worked in his public activities."



WALTER T. BALLOU

Governor Olson expressed his thanks and appreciation to Mr. Chambers for his loyal services as Relief Administrator and Highway Commission secretary and voiced the hope that future developments will permit the further use of Chambers' services in State work.

WANTED IN PHILIPPINES

Collegio De San Carlos, Cebu City, P. I.

Mr. Frank W. Clark, Director,
California Highways
and Public Works
Sacramento, California.

Dear Sir:

We are fortunate this year to have a complete College of Engineering in our institution. We can boast that it is one of the best in the Islands.

We owe our success in building up this college to some contributors in States who have given their help, as in books, magazines or newspapers to our library. In like manner, we would like to beg you to include us in your free mailing list.

Thanking you in advance for the favor, I beg to remain

Very respectfully,

AMANCIO ALCORDO, Dean,
College of Engineering.

State Adopts a Program for Marketing Power

(Continued from page 5)

and 178,000,000 kilowatt hours of secondary power at Antioch.

The figures were based on the assumption that 40 per cent of the \$103,000,000 cost of Shasta Dam would be allocated to power. If the Federal government built secondary transmission lines from the substation at Antioch to city gates the value of the power would be 5.18 mills per kilowatt hour for firm energy and 1.77 mills for secondary energy or an overall average value of 4.70 mills per kilowatt hour.

TOTAL ESTIMATED REVENUE

The total required revenue for repayment, operation and maintenance of the power features of the project was estimated at \$6,652,000 a year. If the entire output were sold at the average figures quoted the income would be \$7,202,000 or 8.3 per cent over the required income.

Attending the conference as representative of the Federal government were:

R. V. L. Wright, Special Representative of Department of Interior;
Walker R. Young, Supervising Engineer of Central Valley Project;
Harvey F. McPhail, Senior Electrical Engineer;
Arthur Goldschmidt, Observer from Office of Under Secretary A. J. Wirts;
G. A. Fleming, Electrical Engineer;
J. R. Riter, Hydraulic Engineer;
Phil Dickinson, Director of Information, Central Valley Project.

Representing the Water Project Authority of California were members:

Frank W. Clark, Director of Public Works, Chairman;
Earl Warren, Attorney General;
Charles G. Johnson, State Treasurer;
John R. Richards, Director of Finance.

Also:

Edward Hyatt, Executive Officer;
A. D. Edmonston, Acting Secretary;
Northcutt Ely, Special Legal Representative, and others.

Haughty One: "Sure, I've three fraternity pins. I've got three boy friends."

Other Gal: "H'm. That puts you a couple chumps ahead of me."



Section of recently improved State Highway No. 17 in Nevada County on new alignment eliminating many curves

Thirty Sharp Curves Eliminated Between Auburn and Grass Valley

By CHARLES H. WHITMORE, District Engineer

MOTORISTS using State Highway No. 17 (Sign Route 49) between Auburn and Grass Valley in Nevada County are now traveling over the recently improved section between one and one-half miles south and one and one-half miles north of Rattlesnake Creek which eliminates much of the worst alignment on this road. This route connects two of the larger towns in the Mother Lode territory and carries a traffic of between 1500 and 2000 cars per day, about 20 per cent of which are trucks.

During the past few years, as average traffic speeds have increased, the many short radius curves on the portion of this road in the vicinity of

Rattlesnake Creek have become increasingly hazardous. As a result, several serious accidents have occurred and many others have been narrowly averted. Improvement of this section has been advocated for some time and funds for reconstruction were included in the current highway budget. The project is about three miles in length and results in a saving in distance of about 0.4 of a mile owing to the fact that the major portion of the construction is on new alignment.

The new alignment includes a total of 5 curves with a minimum radius of 1500 feet, as compared to the 35 curves on the old alignment with a minimum radius of 90 feet. The

many curves on the old route combined to make up a total curvature of 1379 degrees, while the total on the new construction amounts to only 87 degrees, a decrease of 1292 degrees. The new alignment and grades were designed in accordance with standards providing for a traffic speed of 50 miles per hour.

The revision in the alignment necessitated a new crossing over Rattlesnake Creek a short distance upstream from the existing crossing. A double 8- by 7-foot reinforced concrete box culvert was constructed at the new crossing to carry the waters of the creek. A channel change was constructed adjacent to the new crossing and concrete slope paving was

placed in portions of the new channel to prevent erosion.

Roadway excavation necessitated by the new construction amounted to about 150,000 cubic yards and about 430,000 station yards of overhaul were involved. The character of material encountered made it necessary to use both shovel and scraper units in the excavation work.

The material encountered in roadway excavation was unsuitable for subgrade for the planned surfacing and a layer of imported borrow was placed throughout the length of the project over the full width of the 30-foot roadbed. This layer of imported borrow was 0.85 of a foot thick except over a one-half mile section, where the thickness was 0.60 of a foot.

The roadway on this project has a plant-mixed surfacing 22 feet wide by 0.21 of a foot thick over crusher run base 23 feet wide by 0.33 of a foot thick.

The total cost of the new construction was about \$110,000. The contractor was the firm of Hemstreet and Bell, and W. G. Remington represented the State as Resident Engineer.

Highway Through Point Mugu

(Continued from page 13)

the old existing road around the point in order to utilize it for a scenic drive or as an emergency by-pass. The connection at the southeasterly end was made in 1939, and the material for the northwesterly connection was stockpiled alongside and constructed after the new road through the cut had been graded and surfaced in February, 1940. Eighty per cent of the material rehandled was done by shovel and trucks, the remainder being bulldozed directly or cast by the shovel. A total of 30,000 cubic yards of embankment was involved in this latter connecting road.

Surfacing for the new road and for the by-pass around the point consisted of plant-mix surfacing 33 feet wide by 4 inches thick.

The total cost of making this improvement was approximately \$200,000 and took 2½ years to construct. Work proceeded continuously except when the crew was engaged in sea-wall or slide removal operations.

This work was done by State day



New alignment has 5 curves compared with 35 on old road

labor construction forces under M. L. Sullivan, Superintendent, with G. R. Halton, Resident Engineer, and A. N.

George, District Construction Engineer, all under the general supervision of District Engineer S. V. Cortelyou.

New Russian River Jetty Project Gets Under Way With Celebration

CONSTRUCTION of the new jetty project at Jenner at the mouth of the Russian River in Sonoma County got under way on September 26th and is expected to be completed by the end of November.

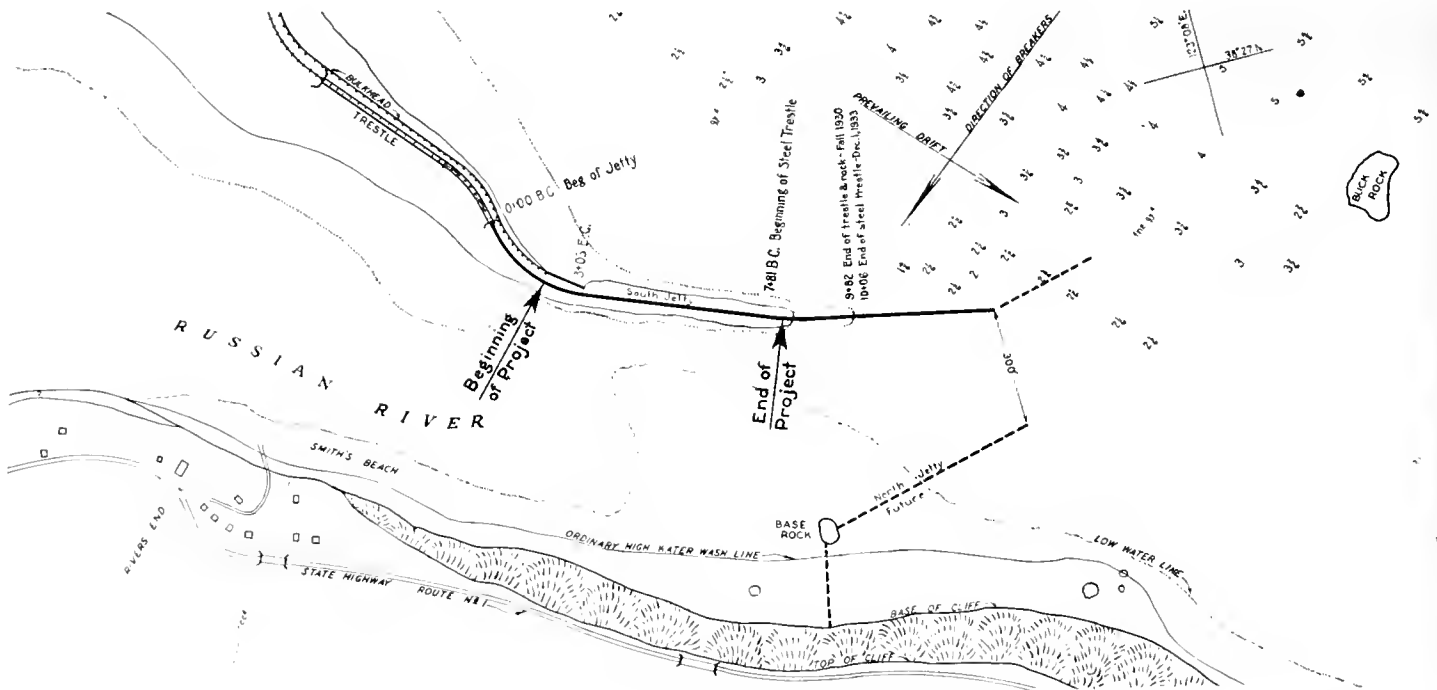
The work is being performed under an agreement between the Department of Public Works and The Basalt Rock Company of Napa. It involves the extension and improvement of the unfinished jetty at Jenner. The amount of the contract is \$48,700.

one-half to one foot slope on the ocean side and one and one-half to one foot on the channel side. The elevation of the crown of the jetty will be 17 feet above low water.

For many years, due to the scouring of the channel of the Russian River during high water periods and the high incoming tides of the Pacific Ocean, the mouth of the Russian River at Jenner has been blocked by sand bars and gravel deposits. The sportsmen of California and the Divi-

required for the jetty will be taken from Goat Rock at Jenner. Manipulating a huge steam shovel at the groundbreaking ceremonies, Doctor E. H. Crawford, who has for years been one of the leaders in the movement to obtain State aid for the project, loaded on a truck the first rock for the jetty wall.

Preceding the ceremony at the mouth of the Russian River attending officials and visitors were entertained at luncheon at Muelenbrock's Resort



Sketch showing present project for improvement of South Jetty at mouth of Russian River now almost closed by drifting sands and proposed future extensions of both the south and north jetties to keep the river open

A total of \$61,050 has been contributed for the project by State and county agencies. The Division of Fish and Game appropriated \$55,000, Sonoma County \$5,500 and Mendocino County \$550, thus providing a reserve fund over and above the amount of the construction contract.

The length of the new jetty extension will be 600 feet. Approximately 1750 cubic yards of concrete and 10,000 tons of rock will be required for the job. The jetty will have a minimum crown width of 12 feet with a

sion of Fish and Game have been particularly interested in this situation because the sand and gravel bars have prevented the seasonal runs of steelhead up the river.

Start of construction on the new jetty was made the occasion for a celebration at Jenner which was attended by State and county officials, sportsmen, and representatives of the various chambers of commerce and civic groups of Sonoma, Mendocino and neighboring counties.

The tons of material which will be

at Jenner, which was presided over by Chairman E. J. Guidotti of the Sonoma County Board of Supervisors. Speech making after luncheon was opened by V. M. Moir, Regional Manager of the North Coast Council of the State Chamber of Commerce. The principal speaker was Senator Herbert W. Slater of Santa Rosa, who led the fight in the Legislature to secure State appropriations for the work.

Guests at the luncheon paid a silent standing tribute to the memory of the late R. L. Jones, Deputy Engineer of



the Division of Water Resources, who supervised the building of the old Jenner Jetty, which is now being rebuilt and extended.

Others called upon included Assemblyman-elect Richard H. McColister of Mill Valley; Malcolm McIntyre, general manager of the Basalt Rock and Gravel Company, who pledged that his company will complete the jetty to the best of the firm's engineering ability; Gerald H. Jones of the State Division of Water Resources, who succeeds the late R. L. Jones; Dr. William Makaroff of Guerneville, president of the Russian River Sportsmen's Club; A. M. Tomasi of Petaluma, president of the Sonoma County Sportsmen's Club; Morgan Keaton, Deputy Director of the Department of Public Works; Fred M. Huson and C. P. Shellenger of the State Engineer's office; Supervisors J. Frank Churchill and George Kennedy.

Insurance Salesman: "Now that you're married and have the responsibility of a wife, you will surely want to take out life insurance."

Bridegroom: "Insurance? Shucks, no. Why, she's not the least bit dangerous!"

Traffic Cop: "Hey, you can't make a turn to the right."

Lady Motorist: "Why not?"

T. C.: "Well, a right turn is wrong here—the left turn is right. If you want to turn right turn left and then—aw, go ahead!"



At top, part of old jetty remaining at mouth of Russian River. Center—Waves destroying construction trestle. Bottom—River mouth almost closed by sand

Sepulveda Boulevard In San Fernando Valley Rebuilt as Divided Highway

By WILLIAM H. MOHR, Assistant Engineer and A. N. GEORGE,
District Construction Engineer

IN THE spring of 1939 Los Angeles city found itself in the situation of having a large amount of Federal money in approved grants for highway construction, but having no money with which to match these grants so as to make them available. The city engineer appealed to the California Highway Commission and it was arranged to make money available to match the Federal grants on certain highways in the city of Los Angeles.

One of the projects was the reconstruction of Sepulveda Boulevard between Ventura Boulevard and Brand Boulevard, a distance of 8.05 miles.

Sepulveda Boulevard has become well known in the last few years as the most direct route from the Ridge Route near San Fernando to West Hollywood and the coastal cities in Los Angeles County. That portion of Sepulveda Boulevard in San Fernando Valley which has just been completed was formerly a narrow road with only a 20-foot pavement in the center.

STATE HANDLED CONSTRUCTION

An agreement was made between the State acting through its Division of Highways and Los Angeles city that the State would prepare the

plans, acquire the right of way and handle the construction engineering on this work, but in order to meet the requirements of the PWA it was necessary for the Los Angeles city, to whom the PWA grants had originally been made, to advertise for bids and award the contracts. Thus it was necessary during construction for the State to deal through the city in all formal matters with the contractors.

Work was immediately started on the plans and the project was divided into two parts so as to make completion possible by the deadline for PWA projects, which was June 30,



Reconstructed section of Sepulveda Boulevard showing railroad right of way used as division strip with new pavement for north bound traffic



Section of Sepulveda Boulevard reconstructed as a divided highway with 4-foot center dividing strip with 5-inch P. C. curbs

1940. The plans as developed provided for a divided highway throughout the length of the proposed improvement. The plans were prepared and right of way obtained so that the first contract, which was from Brand Boulevard to Gamut Place, a distance of 2.8 miles, was awarded to Oswald Brothers, who submitted the low bid of \$143,660. Work was started on this contract on December 11, 1939.

MADE A DIVIDED HIGHWAY

Under this contract the existing pavement on the west side of the Pacific Electric Railway right of way was designed for southbound traffic (to coastal cities) and a new pavement was constructed on the east side of the tracks for northbound traffic (to Ridge Route).

On the west side of the track the old 30-foot pavement was widened to 42 feet between curbs. This improvement consisted of the resurfacing and placing of asphalt concrete pavement 34 feet wide and the construction of 7 feet of plant mix surfacing between the pavement and the 1-foot wide portland cement concrete gutter.

The 34-foot A. C. pavement is designed to permit three traffic lanes 11, 11 and 12 feet wide, respectively.

On the east side of, and adjacent to the railway right of way, there was constructed 22 feet of asphalt concrete pavement. This pavement was placed in three layers and is 6 inches thick, with a thickened edge on the outside. The shoulders were improved for a width of 20 feet with road mix surface treatment and slope to a drainage point 12 feet from the edge of the A. C. pavement.

The Pacific Electric Railway has a right of way width of 40 feet on Sepulveda Boulevard from Brand Boulevard to Gamut Place. This 40 feet has been utilized as a center dividing strip to separate the traffic that flows in opposite directions.

The 40-foot traffic separation island is continuous except for the cross roads, which are one-half mile apart. At these intersecting roads, the railway right of way was paved, making it possible for vehicles to go to the other side of the highway where the traffic is flowing in the opposite direction.

Monolithic portland cement con-

crete curbs and gutters were constructed on each side of the 40-foot center dividing strip. The gutter is 1 foot wide and the curb is 5 inches high and slopes away from the pavement.

SECOND CONTRACT STARTED

The second contract on Sepulveda Boulevard provided for the widening between Gamut Place and Ventura Boulevard, a distance of 5.25 miles. This contract was awarded to the Griffith Company, who submitted the low bid of \$231,339.35. Work was started on this contract on January 22, 1940.

The existing pavement was widened and a 4-foot center dividing strip was constructed. The dividing strip was constructed from Gamut Place to Moorpark Street, which is one block north of Ventura Boulevard. It is continuous except for cross-over openings every 1000 feet and at all street intersections.

On each side of the center island portland cement concrete curbs were constructed 5 inches high with sloping sides. The center of the dividing strip between curbs has been filled

with earth and planted with ice plant cuttings.

The existing 20-foot P. C. C. pavement was widened 4 feet on each side. A portland cement concrete base was constructed 4 feet on each side of the existing pavement. Over the old pavement and the 4-foot widening strip, asphalt concrete resurfacing was placed on each side of the center dividing strip. The resurfacing was placed in 12-foot wide lanes with a minimum thickness of 2 inches.

On each side of center line adjacent to the resurfacing there was constructed a standard 11-foot wide portland cement concrete pavement lane. Outside of, and adjacent to the pavement lanes the shoulders on both sides were treated for a width of 20 feet with road mix surface treatment. The 20-foot shoulders slope to a drainage point 12 feet from the edge of the pavement.

RIVER BRIDGE WIDENED

The existing 100-foot reinforced concrete bridge across the Los Angeles River was widened as a part of the second contract. The two 50-foot spans were widened from 24 to 54 feet from curb to curb. The four-foot center dividing strip was carried continuously across the bridge. A four-foot sidewalk was constructed on each side of the bridge, adjacent to the pavement curb.

A 48-inch storm drain was constructed along Sepulveda Boulevard to carry water from a low point in the highway to the Los Angeles River. This storm drain was placed under the east shoulder and extends northwesterly to the low point. Two cross pipes have been placed under the pavement to drain the surface waters to the storm drain.

When the information was given out that it was proposed to improve Sepulveda Boulevard as a divided highway, considerable opposition developed among abutting property owners, but as the case for the divided highway was explained to them and they were referred to business property on roads which had already been improved as divided highways where the business men were quite unanimous in their belief that their business did not suffer by the dividing of the roadway, the greater portion of the opposition was removed.

It is now believed that the greater bulk of property owners recognize the advantages of the divided high-

An Appreciation

Compton Junior College

601 S. Acacia Street,
Compton, California

Mr. J. W. Howe, Editor
California Highways and
Public Works
Sacramento, California

Dear Mr. Howe:

On behalf of our institution, I am again writing you to express our appreciation of the regular receipt of your bulletin, "California Highways and Public Works."

This publication has been used regularly in connection with the work of the Department of Social Science in this institution, particularly in our classes in Economics and Government. It has been made available for study to the students in the appropriate classes, and we have also maintained a file of the bulletins for some time past.

If possible, I should appreciate your continuing to send me these bulletins regularly in the future. Any other similar materials which you feel might be of educational value to young people between the ages of 18 and 30 will always be gratefully received.

Cordially yours,

Robert C. Gillingham
Chairman Social Studies
Compton Junior College

way and do not feel that it will in any way be detrimental to their property.

The State Division of Highways supervised the construction and provided the inspectors and engineers required on these projects. E. L. Seitz was the Resident Engineer in charge of both contracts under S. V. Cortelyou, District Engineer, and A. N. George, District Engineer.

Actor: "A horse! a horse! my kingdom for a horse!"

Voice from the gallery: "Will a jackass do?"

Actor: "Sure, come right on down."

Highway Service Trend Toward Traffic Efficiency

A SATISFACTORY standard of highway service involves not only adequate physical plant, but also its proper maintenance and efficient operation. For satisfactory transportation can no longer be conceived merely as the economical movement of passengers and freight, but rather as safe movement with speed and comfort.

In the provision of highway transportation it is fairly evident that emphasis has shifted from expansion of plant to modernization, replacement and maintenance. For example, Federal-aid projects today in nearly 60 per cent of all cases are located where previous Federal work has already been done, while much of the remaining work has been reconstruction of previous undertakings by the States and counties.

The increasing importance of the maintenance bill also is evident, State highway expenditure figures since 1921 revealing that while capital outlay in 1938 was less than in 1928, maintenance expenditures had increased by close to \$100,000,000. Comparing the years 1931 and 1937, when capital outlays were identical at \$551,000,000, maintenance expenditures had increased from \$169,000,000 to \$227,000,000.

The newest development in highway expenditure programs, however, has been the growing attention to efficient movement of traffic. Experience on the State highway system of California, for example, provides specific data on expenditures for services directly related to public convenience, safety and comfort. It is revealed that these services, including pavement markings, signs, traffic control devices, roadside development, snow removal and ice control have trebled in cost since 1930. In the next two years the California Division of Highways expects to use approximately 12 per cent of all maintenance funds to comply with the growing demands for a better quality of highway service.—*American Highways*.

Said the angry molecule: "Let me atom."

Model Built to Aid Study of Bridge Design

By Kenneth W. Dowie,
Assistant Bridge Engineer

TO MEET the need of the bridge designer for visualizing the deformations of a structure under loading, and in appreciation of the difficulties of picturing these deformations accurately, a small model rigid frame of spring steel was constructed by the author. The frame consists of three 19-inch spans and two short cantilever arms on four columns about 18 inches high. All members are made of 12 gauge spring steel, columns and girders connected together by soldering the wire to triangular iron plates.

As these members are made of 12 gauge spring steel, they respond very readily to light loads, and with their high elastic limit completely regain their original shape when the load is taken off. Columns are all removable, partly to make it easier to carry the frame around, but mainly to investigate the effect of loading spans of unequal length.

LOCKING DEVICE ARRANGED

The loads shown in the lower illustration weigh one pound each. For horizontal loads, such as would exist in a bridge with earth-filled abutments, or from temperature, seismic or tractive forces, deformations are most clearly shown by applying such loads with the hands.

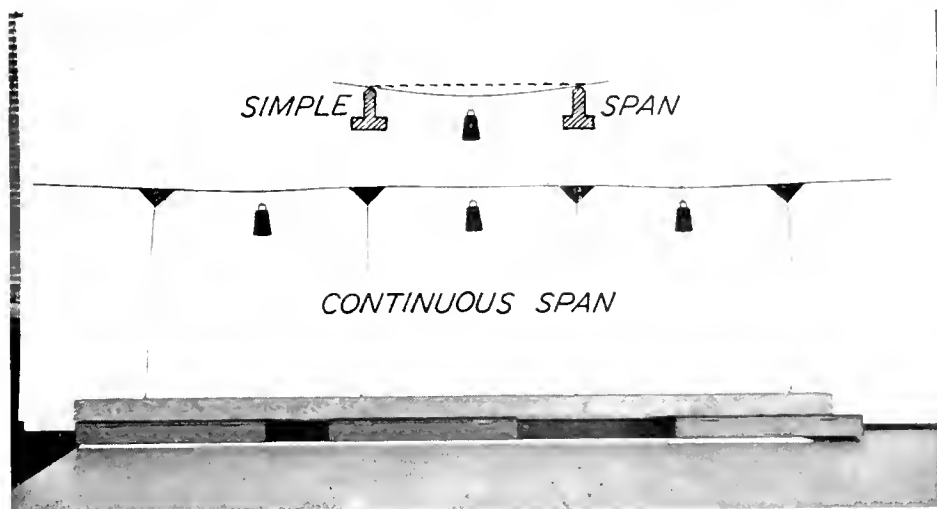
In order to show the difference in stress due to having fixed and free-end columns, a locking device has been arranged that enables the demonstrator to lock or free the base of each column at will. It was found necessary to anchor the column bases, as under unsymmetrical loading some columns developed negative reactions.

If it is desired to show the presence of these negative reactions in a somewhat dramatic fashion, it is a simple matter to loosen the thumb-screw anchors and apply a heavy live load, whereupon some of the columns pop out of the ground.

While it is in no sense a precision instrument it is thought that by means of the model an instantaneous



Method of demonstrating deformations in rigid frame structures, as used by Glenn L. Enke, Associate Bridge Engineer, in his "Bridge Design" class



Comparison with simple span showing increased stiffness of modern continuous bridge

grasp of the deformations is possible, with a clear understanding of the proper loading to secure maximum moments in the various parts of the structure. By placing the proper loads on the model frame, the problem of the correct direction of the bending moments is instantly clarified.

The model shown here has been used in a class of engineers led by Mr. Glenn L. Enke, Associate Engineer of the Bridge Department, and has proved successful in demonstrating dramatically the kind of deformations undergone by a bridge or similar rigid frame under load. In the first illustration, Mr. Enke shows the deformation of such a structure under a truck load on the second span, together with a horizontal load such as

might come from an earth-filled abutment. End columns are fixed and intermediate columns free.

The second illustration shows clearly that the deflection of a simple span is many times that from the same loading for a continuous span. The gain in stiffness from the continuity of a slender frame such as this one is remarkable.

One has only to drive over the deck of a modern continuous type bridge, and compare the riding quality with the hollows and bumps of the old simple span bridge to realize how important is this matter of reducing deflections to a minimum.

In spite of the fact that nearly all the engineers of the Department of

(Continued on page 28)

Highway Bids and Awards for the Month of September, 1940

BUTTE AND PLUMAS COUNTIES—At various locations between Hines Creek and Howell's, about 4 miles, eroded embankments to be reconstructed, rock riprap to be placed as slope protection, rubble masonry to be constructed and drainage facilities to be installed. District II, Route 21, Section C.A.B. A. S. Vinnell Co., Alhambra, \$55,540; Hemstreet & Bell, Marysville, \$57,582; Poulos & McEwen, Sacramento, \$57,828; Harms Bros., Sacramento, \$58,269. Contract awarded to Claude C. Wood, Lodi, \$52,733.

FRESNO COUNTY—Across Four Mile Slough about 27 miles west of Fresno, a reinforced concrete bridge to be constructed and about 0.2 mile of approaches to be graded and surfaced with plant-mixed surfacing. District VI, Route 41, Section P. Piazza & Huntley & Trewitt-Shields & Fisher, San Jose, \$21,335; M. J. B. Construction Co., Stockton, \$21,951; A. S. Vinnell Co., Alhambra, \$25,569. Contract awarded to F. Fredenburg, South San Francisco, \$18,372.

IMPERIAL COUNTY—Between Heber and Niland, about 15.4 miles to be surfaced with road-mix surfacing. District XI, Routes 201,187, Sections A.B.E. Oswald Bros., Los Angeles, \$32,847; Daley Corp., San Diego, \$44,631; V. R. Dennis Construction Co., San Diego, \$49,321; A. S. Vinnell Co., Alhambra, \$49,654; J. E. Haddock, Ltd., Pasadena, \$56,480; Chas. H. Johnston, Los Angeles, \$58,336. Contract awarded to R. E. Hazard & Sons, San Diego, \$31,204.

KERN AND INYO COUNTIES—Between Armistead's and 5.5 miles north of Little Lake, 23.2 miles of penetration oil treatment and seal coat to be applied. District IX, Route 23, Sections DE and GH. Vido Kovacevich, South Gate, \$12,270; A. S. Vinnell Co., Alhambra, \$12,827; Basich Bros., Torrance, \$14,483. Contract awarded to Brown & Doko, Pismo Beach, \$11,987.

LAKE COUNTY—About 15 miles east of Lucerne, eroded embankments to be replaced, sacked concrete riprap slope protection to be replaced, and road-mix surfacing to be applied. District I, Route 15, Section C. Helwig Construction Co., Sebastopol, \$6,910. Contract awarded to Harold Smith, St. Helena, \$6,585.

LOS ANGELES COUNTY—On Arroyo Seco Parkway, between Grand Avenue and Fair Oaks Avenue, about 0.7 mile to be graded and paved with portland cement concrete and asphalt. District VII, Route 205, S.Pas. Oswald Bros., Los Angeles, \$81,163; Griffith Co., Los Angeles, \$87,405; Oscar Oberg, Los Angeles, \$88,437; Sander Pearson, Santa Monica, \$99,758; Radich & Brown, Burbank, \$102,353; Carlo Bongiovanni, Los Angeles, \$109,999. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$79,699.

MENDOCINO COUNTY—Steel piles and steel pile splices for repairs to Noyo River Bridge. District I, Route 56, Section E. Contract awarded to R. G. Clifford, San Francisco, \$1,860.

MENDOCINO COUNTY—Across Schooner Gulch about 3½ miles south of Point Arena, a reinforced concrete bridge to be constructed and about 0.13 mile of roadway to be graded and an armor coat applied. District I, Route 56, Section A. A. T. Beckett, Oakland, \$72,473; S. J. Amoroso Construction Co., San Francisco, \$75,537; Fred J. Maurer & Son, Eureka, \$76,998; C. W. Caletti & Co., San Rafael, \$83,737; R. G. Clifford, South San Francisco, \$91,768; The Utah Construction Co., San Francisco, \$93,440. Contract awarded to Harold Smith, St. Helena, \$71,841.

MERCED COUNTY—Between Merced and Tuttle, about 3.3 miles to be graded and surfaced with plant-mixed surfacing. District X, Route 18, Section A. S. M. McGaw, Stockton, \$51,982; Louis Biasotti & Son Valley Construction Co., Stockton, \$52,867; Piazza & Huntley, San Jose, \$55,428; M. J. B. Construction Co. & F. Kaus, Stockton, \$56,859; Claude C. Wood, Lodi, \$57,284; Marshall S. Hanrahan, Redwood City, \$67,138. Contract awarded to J. A. Casson Co., Hayward, \$48,878.

SAN DIEGO COUNTY—On Washington St., between Fifth Avenue and Ninth Avenue, about 0.3 mile to be graded and surfaced with plant-mixed surfacing on crusher run base and portland cement concrete pavement to be constructed. District XI, Washington St. B. G. Carroll & Harry L. Foster, San Diego, \$31,359; Griffith Co., Los Angeles, \$31,851; Daley Corp., San Diego, \$31,988; R. E. Hazard & Sons, San Diego, \$33,584. Contract awarded to V. R. Dennis Construction Co., San Diego, \$29,744.

SAN LUIS OBISPO COUNTY—At Miles Station about 1.4 miles to be graded and surfaced with plant-mixed surfacing. District V, Route 2, Section E. Frederickson & Westbrook, Sacramento, \$157,055; Utah Construction Co., San Francisco, \$167,767; J. E. Haddock, Ltd., Pasadena, \$175,339; A. Teichert & Son, Inc., Sacramento, \$181,768; N. M. Ball Sons, Berkeley, \$186,775; Basich Bros., Torrance, \$195,325; Oswald Bros., Los Angeles, \$198,037; McNutt Bros., Eugene, Oregon, \$225,146. Contract awarded to Gibbons & Reed Co., Burbank, \$149,803.

SAN LUIS OBISPO COUNTY—Across San Luis Obispo Creek about six miles south of San Luis Obispo, a reinforced concrete girder bridge on concrete bents with pile foundations to be constructed. District V, Route 2, Section E. C. W. Caletti & Co., San Rafael, \$77,839; J. E. Haddock, Ltd., Pasadena, \$78,583; R. H. Travers, Los Angeles, \$79,746; Oberg Bros., Los Angeles, \$79,811; Byerts & Dunn, Los Angeles, \$82,268; Trewitt-Shields & Fisher, Fresno, \$82,692; Gibbons & Reed Co., Burbank, \$84,933; M. J. B. Construction Co. & F. Kaus, Stockton, \$88,206; The Utah Construction Co., San Francisco, \$94,554. Contract awarded to Dan Caputo, San Jose, \$68,388.

SANTA BARBARA COUNTY—Across Dos Pueblos Creek, 16 miles north of Santa Barbara, a reinforced concrete bridge to be constructed. District V, Route 2, Section G. J. E. Haddock, Ltd., Pasadena, \$23,131; J. S. Metzger & Son, Los Angeles, \$24,856; J. J. Munnemann, Santa Barbara, \$26,000; Byerts & Dunn, Los Angeles, \$27,622. Contract awarded to Carl Hallin, Los Angeles, \$22,966.

SONOMA COUNTY—About 2.5 miles north of Cloverdale, about 0.4 mile to be graded and surfaced with plant-mixed surfacing. District IV, Route 1, Section D. Mace Construction Co., Clearwater, \$74,957; Claude C. Wood, Lodi, \$83,970; Frederickson & Westbrook, Sacramento, \$88,972; Harms Bros. and N. M. Ball Sons, Berkeley, \$89,608; Louis Biasotti & Son, Stockton, \$90,052; Fredrickson Bros., Emeryville, \$90,573; McNutt Bros., Eugene, Ore., \$94,537; Hemstreet & Bell, Marysville, \$95,120; R. E. Campbell, Los Angeles, \$98,412; Piombo Bros., San Francisco,

\$104,867; A. Teichert & Son, Inc., Sacramento, \$125,677; A. S. Vinnell Co., Alhambra, \$130,354. Contract awarded to Heafey Moore Co. and Fredrickson & Watson Construction Co., Oakland, \$72,732.

SUTTER COUNTY—At Berg and Lomo about 0.4 mile to be graded and surfaced with plant-mixed surfacing on crusher run base. District III, Route 3, Section A. Claude C. Wood, Lodi, \$13,933; C. M. Syar, Yuba City, \$13,333. Contract awarded to Hemstreet & Bell, Marysville, \$10,883.

TRINITY COUNTY—At various locations between Big Bar and Helena, about 3.4 miles to be graded, portland cement concrete cribbing, rock slope protection and drainage facilities to be constructed. District II, Route 20, Section E. Scheumann & Johnson, Eureka, \$87,054; A. S. Vinnell Co., Alhambra, \$87,694; Hemstreet & Bell, Marysville, \$86,475; Poulos & McEwen, Sacramento, \$94,997. Contract awarded to Clifford A. Dunn, Klamath Falls, Oregon, \$72,875.

Model Built to Aid Study of Bridge Design

(Continued from page 27)

Public Works are graduate engineers they have found continuous study necessary in order to keep pace with the fast development of our technical world.

Several classes of special interest to engineers have been organized through the Committee on Education of the State Employees Chapter No. 2. Nearly 140 engineers attended the class conducted by Engineer Enke, most of whom were from the Department of Public Works. Those attending the class receive valuable syllabus material covering the latest information on bridge design practice. This class is being continued again this year.

Two new classes were inaugurated this year that have proved very successful. One is a class in foundation engineering, conducted by Mr. O. J. Porter, Senior Testing Engineer for the testing laboratories of the Division of Highways. Approximately eighty engineers have enrolled in this class. The other class, conducted by R. W. Hutchinson, Associate Bridge Engineer, goes into the analysis of indeterminate structures by moment distribution. Nearly fifty engineers of the Department are enrolled.

These classes are being held at Sacramento Junior College in conjunction with adult education division.

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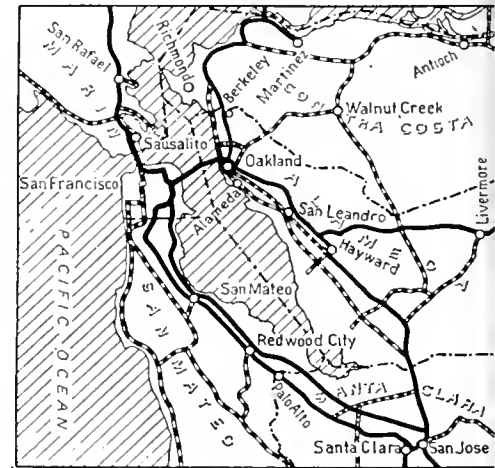
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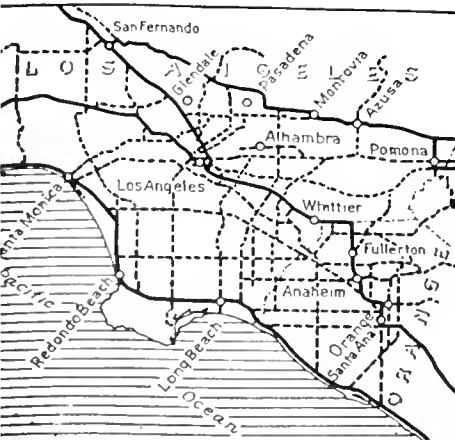
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MAP
SHOWING
STATE HIGHWAY SYSTEM

LEGEND
Primary Roads —————
Secondary Roads - - - - -
Proposed Roads
See Detail Map



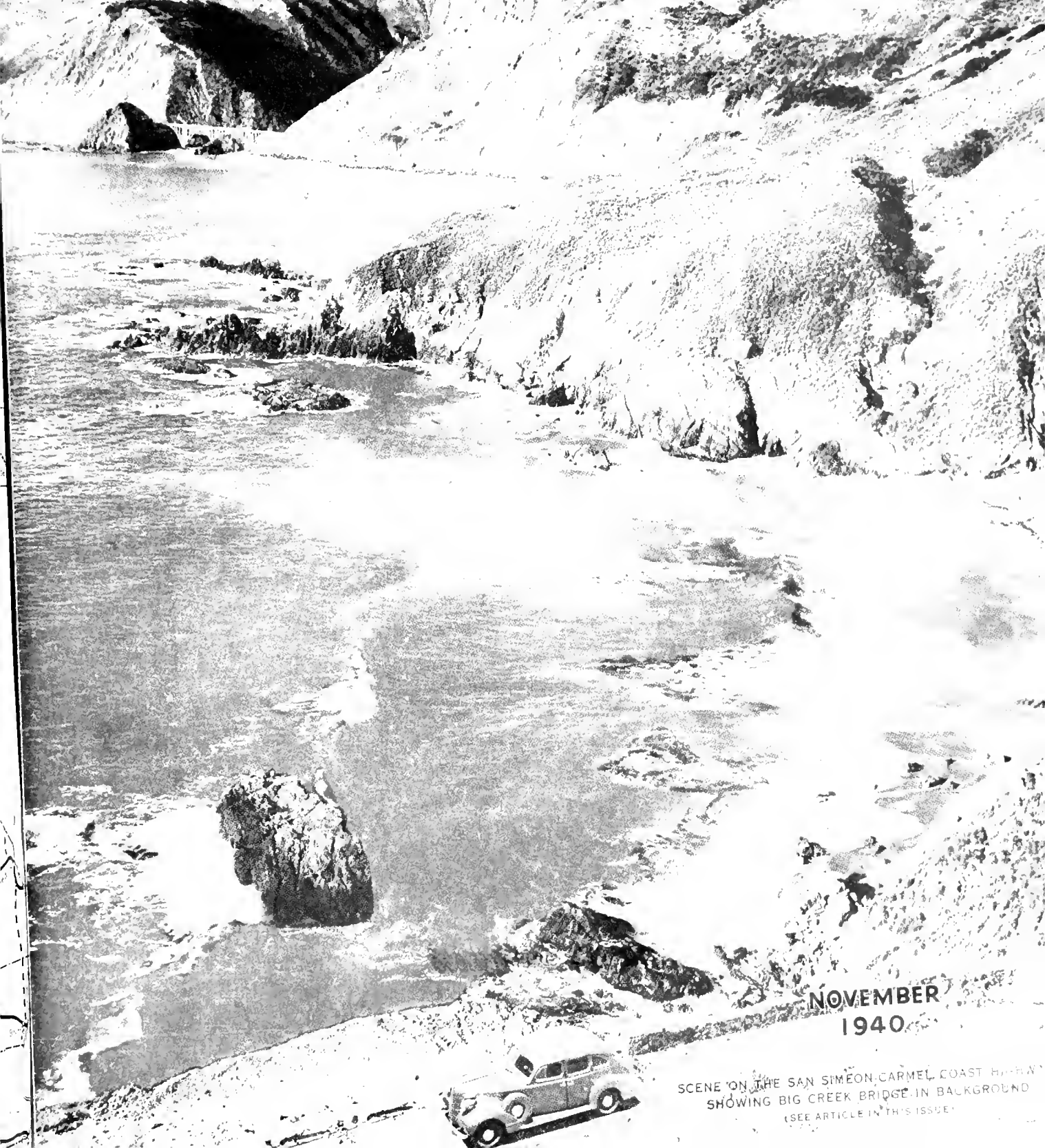
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CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



NOVEMBER
1940

SCENE ON THE SAN SIMEON-CARMEL COAST HIGHWAY
SHOWING BIG CREEK BRIDGE IN BACKGROUND
(SEE ARTICLE IN THIS ISSUE)

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California

FRANK W. CLARK, Director

C. H. PURCELL, State Highway Engineer

J. W. HOWE, Editor

K. C. ADAMS, Associate Editor

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Photo by U. S. Signal Co.

Such roads as this one hamper rapid movement of mechanized units of the Army and must be widened and realigned for National Defense

Highways for National Defense

By C. H. PURCELL, State Highway Engineer

WITHIN the past two years the mind of the American public has become focused on the urgent necessity of more complete preparedness for national defense. There has been a great deal of discussion both in Congress and elsewhere relative to the measures to be taken. Demands for increased production of planes, automotive equipment, and munitions have held the center of public thought.

Within the past year, however, nascent sentiment has been crystallized realization that one of the most tant weapons of defense is a articulated system of highways provides adequate connection all parts of the nation.

effect upon highway construction California by the necessary investment in the financing of its to meet the demands of the sed defense system will be faring. The results of surveys in this State for proposed iments which would be required re strategic road system indiat approximately \$150,000,000 e required in California. In on to this amount, a sum of \$11,000,000 will be necessary nstruction of access roads to

the several cantonments, naval and military reservations planned for this State.

INADEQUACY OF FUNDS

The appalling inadequacy of funds which will be available for highway improvement is clearly seen when these figures are compared with anticipated Federal Aid to be apportioned to California during the next two years and the total expected State revenue.

California's regular Federal Aid appropriations for the next biennial budget have been reduced 25 per cent which places an additional burden on this State in meeting defense demands.

It has long been known that the success of the Caesars during the four centuries when the Roman Empire held the world in subjugation was largely due to the substantial road system over which the legions could move quickly from front to front.

FOR MECHANIZED ARMIES

In the present conquest of continental Europe by the mechanized armies of the Hitler regime the outstanding feature has been the rapid mobility of large numbers of troops

and vast trains of heavy motorized equipment. Germany, by reason of her network of superhighways, was capable of throwing her military to the borders of Czecho-Slovakia, and Poland, then to Denmark and its position for the invasion of Norway, back through Holland and Belgium, on to Paris and the channel ports. The perfection of the Nazi military organization would have been useless without the interlocking system of German highways which were turned into arterials for the armed forces and their supplies.

In the United States, with 3000 miles from the Atlantic seaboard to the Pacific Coast and 2000 miles from Canada to Mexico and the Gulf, any program for national defense must give first consideration to the vital necessity of a complete network of military highways. This network must provide routes over which the National army and thousands of pieces of heavy motor equipment may be moved at high speeds and without congestion. It must tap the sources of raw materials and agricultural products and connect them with the centers of manufacture and industry. It must lead from the hubs of distribution to the points of



Photo by U. S. Signal Corps

Some highways and narrow bridges on roads of military importance in California will not accommodate these heavy tanks

strategic importance. It must have the strength in its weakest link to bear the burden which a nation prepared for defense will place upon it. It must be the base upon which may be built the entire program for National Defense.

FOUNDATION NETWORK EXISTS

To American highway engineers and officials, knowledge of these facts is not new. Highway development throughout the country has been advancing at an ever increasing pace during the last three decades. It is true that the standards used in building American roads have been governed largely by the needs of commercial traffic, nevertheless, development of the automotive equipment of commerce has been such that it parallels in size, weight and speed, equipment necessary for modern military operations.

The result is that, while there remains an enormous task of road building to be immediately accomplished, this nation has in the several State highway systems the foundation for the national network required by a complete defense program. The work ahead will be to push forward

from where we are, with the gratifying knowledge that investments made up to this time will not be lost but will become an integral part of the complete network.

Trained organizations for taking the necessary steps are now functioning in the Public Roads Administration and the several State highway departments. The need is for immediate finances.

MUST STEP UP PROGRAM

We can not, however, sit back and complacently expect the rate of progress which has been normal for the past ten years to be adequate for the task which now confronts us. Highway construction programs in recent years have been based upon peace time plans for development over long periods. The urgent necessity for providing an adequate national highway system demands that road construction programs in all States must be tuned to the same tempo as other phases of defense preparedness. Trained armies with the most modern equipment and munitions are of no avail if adequate highways are not available for their transportation to any destination.

With full realization of these facts the American Association of State Highway Officials, State highway departments, and Public Roads Administration, the Congressional Road Committee, American Road Builders Association, and others have worked to impress upon the public mind and upon the Congress the urgency of the situation and the necessity for immediate action and the stepping up of road and bridge construction to assembly-line speed.

Working together, the War Department and the Public Roads Administration estimated the highway needs of the nation for adequate defense purposes.

As result of this collaboration it was definitely determined that "military requirements would impose no standards for roads or bridges superior to those that would be required for the accommodation of normal commercial traffic." The estimate of construction needs showed further that "in greater part, the roads recommended by the War Department have been included in the Federal-Aid system and that with few exceptions they are the roads most needed in normal peace time life."

NEEDS OF NETWORK

The War Department, as a result of the conferences with the Public Roads Administration has stated that there are approximately 75,000 miles of highways on existing road systems which have special military and strategic value. Many miles of this strategic system, however, are in need of immediate widening, straightening and strengthening.

Figures issued by Federal Works Administrator Carmody give the following statistical data with reference to the strategic system.

Total mileage in the network	75,000 miles
Total number of rural bridges	16,000
Number of bridges with load capacity less than 30,000 pounds	1,800
Number of rural bridges with vertical clearance less than 12½ feet	150
Number of rural bridges with horizontal clearance less than 18 feet	1,700
Mileage of road surface less than 18 feet wide	5,500 miles
Mileage of road surface needing to be strengthened	14,000 miles

The Public Roads Administration, with the cooperation of the various State highway departments is now conducting an exhaustive engineering

survey to determine the cost of improving the roads and bridges in the strategic system. The results of this survey will be available shortly.

In addition to the roads which are on existing highway systems, the War Department estimates that there will be needed construction of some 3,100 miles of highway to give access and connection with 120 cantonments and military reservations.

Standards to which the improvements are to be made will conform to the best practice now in use in State highway construction.

CONSTRUCTION OF BY-PASSES

It is not to be understood, however, that the program will require super-highways throughout the entire strategic system. Similar to highways for peace time activities certain military roads will serve as arterials and others as secondary routes feeding into the arterials. Requirements for standards of improvement form definite patterns on the basis of traffic volumes.

One of the most vital problems, however, will be construction of necessary by-passes around metropolitan areas. Troop and supply

movements can not be jeopardized by meeting congested traffic in urban bottlenecks and ample provisions must be made to eliminate any such possibilities.

Immediate financing of this program for development of the military system is the problem which now confronts the nation and it must be realized that in accomplishing the development certain local highway programs now planned may of necessity be deferred.

Naturally, any defense system of highways will supplement the service the railroads will be able to furnish the army and navy. I believe it to be important that all highway officials work in cooperation with the railroads in the ultimate working out of defense transportation problems. It is proper that highway departments work closely with army and navy officials in selecting the routes most needed for national defense.

From preliminary estimates of proposed apportionments to the State of Federal Aid funds it appears that California will receive during the fiscal years ending June 30, 1942 and '43 only about \$10,400,000 for regular Federal Aid, Federal Aid Sec-



Photo by U. S. Signal Corps

Narrow and structurally inadequate bridges such as the one shown in this photograph offer problems of troop movements.



Photo by U. S. Signal Corps

Surfacing on numerous highways of strategic value will not long stand up under the pounding of heavy mechanized army equipment.

ondary and Federal Aid Grade Crossing funds. California must match the regular Federal Aid and Secondary funds with some \$8,900,000 which will make a total of only \$19,300,000 for the first two years of the \$150,000,000 program for strategic roads in California.

It is most apparent, therefore, that the Federal government must provide additional money for the strategic roads and for the access roads in greatly increased amounts if the program for national defense is to be accomplished.

On the basis of the evidence presented to the Congressional Road Committee Congress passed and the President signed a new Federal Aid Highway Act which appropriated and authorized expenditures of \$327,000,000 for the fiscal years ending June 30, 1942 and 1943. This means a total of \$163,000,000 for each year will be provided by the Federal government for road construction projects throughout the nation. Official apportionment to the States has not as yet been made but the Federal Works Administrator has announced an approximate apportionment for each year of \$97,500,000 for Regular

Federal Aid, \$17,063,000 for Secondary or feeder roads and \$19,500,000 for grade crossing elimination.

The Regular Federal Aid and Secondary funds must be matched by the States.



Photo by U. S. Signal Corps

This road to be of any importance to the military forces must be widened

For the construction of the 3,100 miles of special access roads to cantonments and military locations it is estimated about \$202,000,000 will be required. These funds must be supplied in addition to those provided in the Federal Aid Act.

Provisions of the new Federal Aid Act provide that the Commissioner of Public Roads may give approval to and expedite the construction of projects recommended as important to national defense with any unobligated funds apportioned to any State as Federal Aid. Thus in addition to the \$327,000,000 provided for the fiscal years ending in 1942 and 1943 there remains some \$181,000,000 in 1940-41 authorizations which are still unobligated and are therefore available for defense priority construction.

These sums together with State money which must match Federal Aid will provide more than \$800,000,000 for use in the building of the strategic system.

The problem of defense highways is known, funds for a considerable portion of the work are authorized or appropriated, State highway departments and the Public Roads Administration have the organizations to accomplish the task and the program will soon be rolling towards completion.

Defense Highways Demand More Funds

Make the Highways Safe for the Army might well have been the motto of the more than 550 delegates who attended the twenty-sixth annual national convention of the American Association of State Highway Officials in Seattle September 16-19 where the problem of making the nation's roads adequate to meet military demands was the principal topic. And paramount among resolutions adopted was one calling upon the Federal Government to make sufficient funds available as will insure early completion of an adequate system of strategic highways necessary for proper defense. The same resolution pledged the services of the Association in carrying out the program.

Indicating the magnitude of the defense highway program, Congressman James W. Mott of Oregon in his address to delegates recommended Congress pass a special bill to make possible a 1,000,000,000 schedule of

RESOLUTIONS ON NATIONAL DEFENSE

Adopted by The American Association of State Highway Officials at Seattle, Washington, September 19, 1940, as follows:

Whereas, Our country is at the present time definitely committed to the adoption of adequate defense measures; and

Whereas, Any adequate plan for national defense requires a comprehensive system of improved highways for the rapid and efficient transportation of men, equipment and supplies; and

Whereas, Large expenditures of public funds will be required, to insure the early construction and reconstruction of strategic highways selected by the War Department for national defense purposes; and

Whereas, The expense of providing such a system of defense highways is definitely beyond the financial capacity of the individual states; and

Whereas, This Association believes that the expense of providing an adequate system of national defense highways is primarily the obligation of the Federal Government, representing as it does all the interests of our people, and that expenditures for such a highway system are proper charges in a defense program; therefore, be it

Resolved, That this Association recommends that the Federal Government provide and make available separate and sufficient funds on such basis as will insure the early completion of an adequate system of strategic highways necessary for proper defense; and be it further

Resolved, That this Association again tenders its services to the President and the Congress and respectfully suggests that the technical and other organizational services of the Public Roads Administration, and the Highway Departments of the several states—constituting as they do, agencies which have amply demonstrated their ability to readily and efficiently initiate and carry to completion the extensive highway programs heretofore undertaken in our country—are at their disposal for carrying out any highway improvement program, essential to our national defense.

construction and improvement. Mott is a member of the House roads committee.

Consensus of delegates and speakers at the conclave was that reconstruction and not construction of new super-highways is the primary problem. Widening, straightening and strengthening of highways, construction of by-passes to route traffic around large population centers, and reconstruction of bridges to bring them at least up to the minimum loading standard of II-15 were listed by engineers as first steps in improving the highway system.

Enlarging upon his proposal for a billion-dollar appropriation from Congress, Congressman Mott said he believed the new defense program should be in addition to the regular Federal Aid work, with the government contributing the major portion of it. Said he:

"I should say not less than 75% of the cost, and perhaps as much as 80 or 85% should be borne by the Federal government, instead of the 50-50 contribution which now prevails."

Declaring the main highways are ideally located for defense purposes, in the opinion of the War Department, Congressman Mott expressed confidence in the ability of road builders to continue their efforts toward national defense objectives without the confusion and uncertainty which marks other phases of the defense program.

T. H. MacDonald, Federal Commissioner of Public Roads, said statewide surveys form a secure foundation for sound policies, and provide detailed information for effective and immediate action toward making the highways suitable for military and defense purposes.—*Western Construction News*.

Public Agencies and Publicly-owned Electric Facilities

IN LESS than five years, electric energy from the Shasta Power Plant of the Central Valley Project will be flowing over transmission lines to serve the project itself and the domestic and commercial users in northern California.

With an initial capacity of 300,000 kilowatts the hydro-electric plant will generate an average of 1,500,000,000 kilowatt hours annually. Combined with a steam-electric power plant tentatively proposed at Antioch, it will be capable of serving a general power load of 2,000,000,000 kilowatt hours or about one-third of the present power load in northern California.

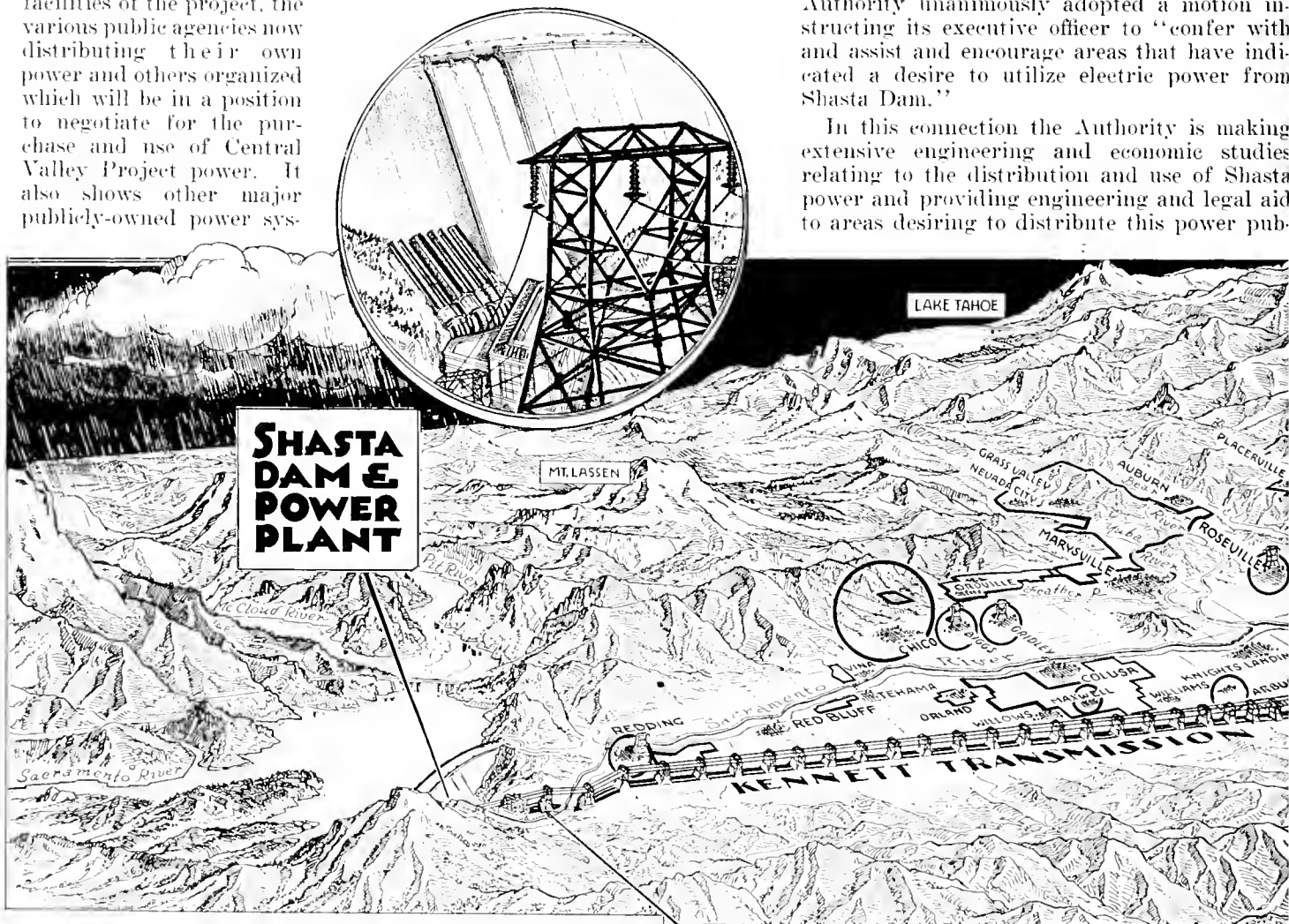
The accompanying artist's sketch shows the power facilities of the project, the various public agencies now distributing their own power and others organized which will be in a position to negotiate for the purchase and use of Central Valley Project power. It also shows other major publicly-owned power sys-

Santa Clara. The Modesto and Turlock Irrigation Districts generate and distribute their own power.

The Sacramento Municipal Utility District is in the process of acquiring its own distributing system. Assistance in acquiring Central Valley Project power for public distribution has been sought through the Water Project Authority of California by the Glenn-Colusa Irrigation District, Bidwell Municipal Utility District, East Contra Costa Irrigation District, Santa-Carbena Irrigation District, West Stanislaus Irrigation District, Byron-Bethany Irrigation District, Waukena-Packwood Canal Area.

At its meeting on September 24th, the Water Project Authority unanimously adopted a motion instructing its executive officer to "confer with and assist and encourage areas that have indicated a desire to utilize electric power from Shasta Dam."

In this connection the Authority is making extensive engineering and economic studies relating to the distribution and use of Shasta power and providing engineering and legal aid to areas desiring to distribute this power pub-



**SHASTA
DAM &
POWER
PLANT**

tems in the State, namely the Hetch Hetchy and Boulder Dam developments which could be interconnected with the Central Valley Project.

Under State and Federal laws public agencies will be given preference in the sale of Central Valley Project power. These agencies as indicated on the map are: public agencies already distributing electric energy through publicly-owned systems; municipal utility districts and existing irrigation districts legally constituted to own and operate electric power distribution systems.

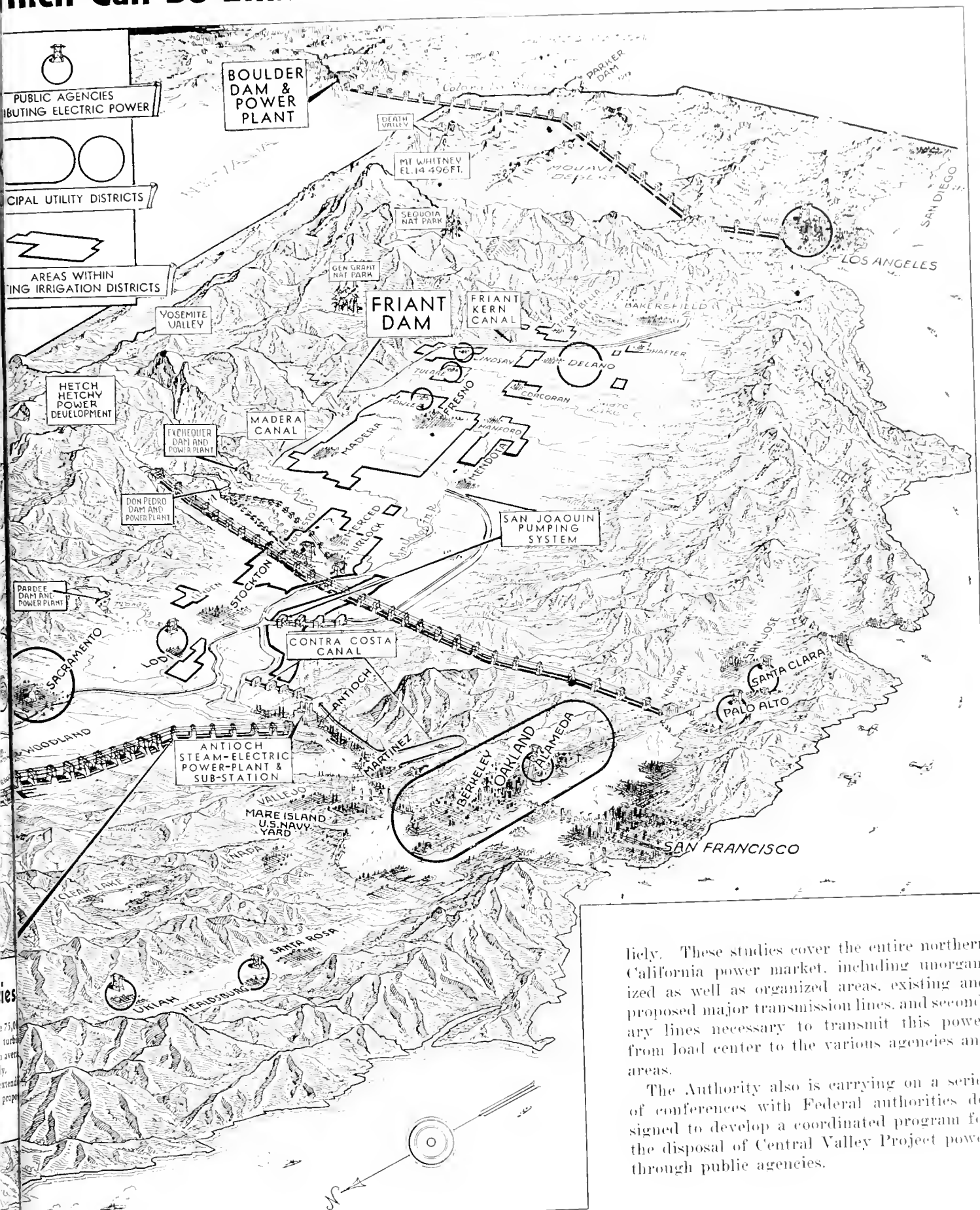
Within the general market area for Shasta Dam power these cities are now distributing power through publicly-owned systems: Redding, Biggs, Gridley, Roseville, Lodi, Ukiah, Healdsburg, Alameda, Palo Alto and

Central Valley Power Facilities

Shasta Dam hydro-electric plant will accommodate five 75,000 kilowatt generators, each driven by a 103,000-horsepower turbine. Initial installation is four units. The plant will generate an average of 1,500,000,000 kilowatt hours of electric energy annually.

Kennett transmission lines will be 200 miles long, extending from Shasta Dam to a sub-station near Antioch. The project capacity is 300,000 kilowatts.

Which Can Be Linked to Central Valley Project Power



hich. These studies cover the entire northern California power market, including unorganized as well as organized areas, existing and proposed major transmission lines, and secondary lines necessary to transmit this power from load center to the various agencies and areas.

The Authority also is carrying on a series of conferences with Federal authorities designed to develop a coordinated program for the disposal of Central Valley Project power through public agencies.



View of Niles Canyon showing new highway around relocated stream bed and one of two bridges eliminated by new alignment

River Bed Moved to Make Room For Niles Canyon Road Relocation

By J. J. STOCKARD, Associate Highway Engineer

IN 1937 a major highway construction project at the lower end of Niles Canyon was completed, whereby six modern grade separation structures and a bridge over Alameda Creek removed the menace of the old railroad grade crossings and an obsolete inadequate bridge—all in vicinity of Niles in Alameda County about half way between Oakland and San Jose at the junction of State Sign Routes Nos. 17 and 21.

And now another noteworthy contribution is made to the highway facilities of the Niles neighborhood by reconstructing one mile of the

Niles Canyon road, on Sign Route 21, eastward from its junction with Route 17 whereby alignment is greatly improved and two inadequate and dangerous bridges are eliminated.

Niles Canyon is one of Nature's outstanding contributions to the convenience and economic well being of the bay region. It was cut through the mountain chain by the small river called Alameda Creek. Early in the bay region settlement, pioneer highway builders and the railroad companies began to encroach upon the river's valley floor until now there are two railroads

and a highway contending with the river for living space.

The mile of construction here referred to is the most pronounced of these acts of benign usurpation, in that the entire river bed for this mile of relocation was moved over to make room for the new highway. The construction was designed to utilize materials from new channel excavation to build the highway roadbed, and to furnish boulders for riprap bank protection against attack by the river in flood stages.

An alternative to this plan of reconstruction was to build two new bridges over Alameda Creek and

straighten out the existing road as much as bridge controls would permit. This alternative would have entailed a first cost equal to or more than that of the work as actually done. In addition there would have been the cost of perpetual maintenance of the two bridges.

TRAFFIC SERVICE AND BENEFITS

Traffic over this canyon road has summer counts of around 4300 cars on Sundays and holidays, and about 1500 on week days. The road affords a low level grade between bay points and the Livermore Valley. The heavily loaded trucks with trailers using this highway, in spite of the two obsolete and ancient bridges along the way, have made this improvement imperative, and it is with a sense of great relief that the Division of Highways has been able to furnish traffic this fine new stretch of highway and at the same time provide the river with a better channel bed than the one we have taken it from.

The upper bridge of the two displaced has been demolished and removed, but the lower bridge was returned to Alameda County as a provision to serve a few home sites and summer camp grounds.

TYPE OF CONSTRUCTION AND COST

The new road has four curves with a total of less than one-half circle, as against eight curves with very nearly one complete circle of curvature in the section of old road displaced. Also on the new road the shortest radius curve is 700 feet as against a 60-foot radius on the old road.

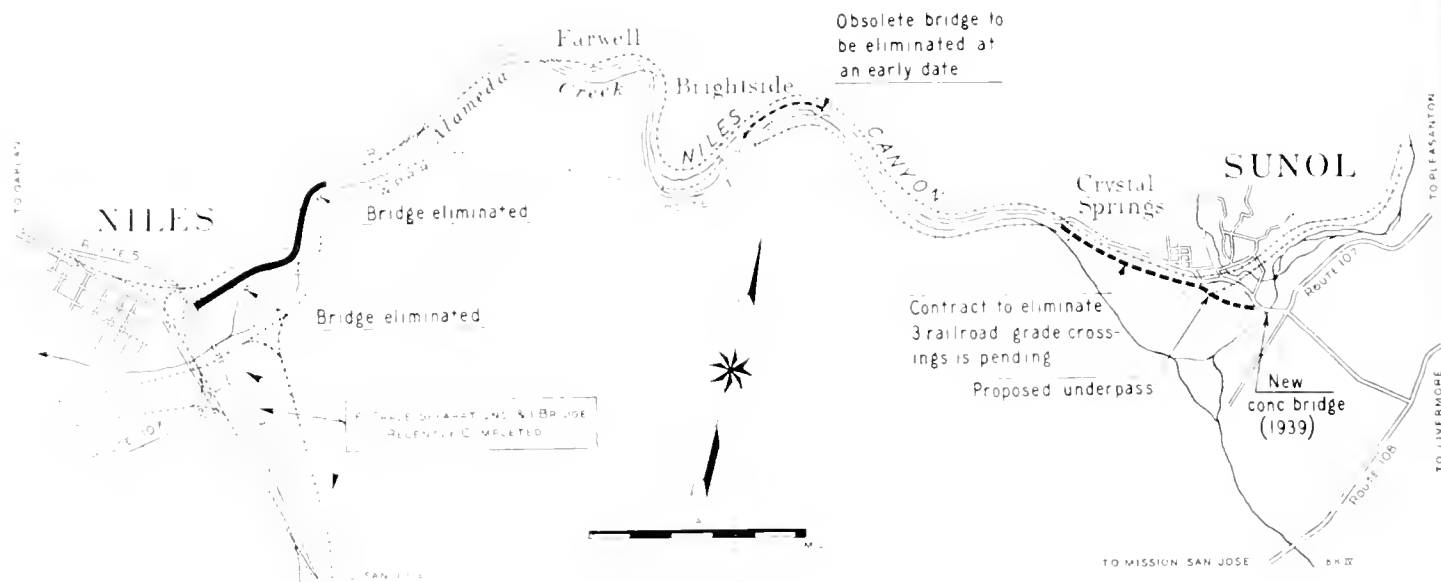
The new location shortens the distance nearly one-tenth of a mile as compared with the old road or any other feasible line of construction.

The new roadway is thirty-six feet wide exclusive of dikes and gutters. A top course of selected gravelly material blankets the entire roadbed to a minimum depth of one foot and upon this base is placed a 0.21 by 22-foot plant-mix surfacing with 7-foot penetration oil treated shoulders.

Coarse rock and boulders encountered in excavating the new river channel were grouted in place along embankment slopes exposed to flood waters, and where necessary toe trenches were dug and this protection was extended below flow line to prevent undercutting the roadbed.



Another view of Niles Canyon showing channel change and new highway. Railroad adjacent on the right is screened from view



Detail of the boulder facing set in Portland cement for slope protection

The boulder facing was dragged to place by mechanical means, washed clean of dirt and fines before placing the portland cement grout which was flushed into voids to a depth of about eighteen inches.

Practically throughout the length of this project the railroad right of way joins the highway on one side and the river channel on the other, so that the greatest possible use is made of available space of the valley floor.

Nearly all the right of way required was included in the old Spring Valley holdings now belonging to the City of San Francisco.

Cost of construction was a little less than \$75,000.

As related to this improvement a project is now being advertised for contract whereby three railroad grade crossings at the easterly end of Niles Canyon, in the vicinity of Sunol, will be eliminated. Also at Sunol a new bridge over Arroyo De La Laguna was recently completed and it is planned to eliminate, at an early date, the only remaining obsolete structure in Niles Canyon.

This latest completed improvement is directly integrated with the scheme of high standard reconstruction in the Niles vicinity, and is a very attractive part of that system.

Motor vehicles traveled 287 billion miles in 1939 and carried passengers ten times farther than all other forms of transportation combined.

Add dictator definitions: An iron man on a steel job.

Central American Official Visitors Amazed By Our Highways



Left to right:—Juan Jose Martinez-Lacayo, Consul General of Nicaragua at San Francisco; Madame Julia Cortes; Leo J. Smith, Department of Public Works; Dr. Leon Cortes, former President of Costa Rica; Arturo Fernandez-Ardon, Consul General of Costa Rica at San Francisco

“CALIFORNIA'S highways have delighted and amazed me.”

This tribute to the State highway system was paid by Dr. Leon Cortés, former president of Costa Rica, following a tour throughout California last month.

Dr. Cortés, who served as chief executive of the Central American Republic from 1936 to 1940, was accompanied on his trip by Madame Cortés Arturo Fernandez-Ardon, Consul-General of Costa Rica at San Francisco, and Juan Jose Martinez-Lacayo, Consul-General of Nicaragua at San Francisco and former Governor of Granada, Nicaragua.

The party motored north from San Diego through the San Joaquin Valley to Yosemite and thence to Sacramento, where the members visited with Governor Culbert L. Olson and Director of Public Works Frank W. Clark. From Sacramento the distinguished visitors toured the Sacramento Valley and the Redwood Empire.

Dr. Cortés was greatly impressed by California's 14,000 miles of State

highway. His own country has approximately 700 miles of highway, mostly asphalt concrete roadways, largely located in mountainous areas.

These highways are maintained by government tax on petroleum products which the government of Costa Rica controls.

“One of my most vivid impressions of the California highway system,” Dr. Cortés told Director Clark, “is your excellent system of highway maintenance. California highways are among the most beautiful in the world and the manner in which they are maintained arouses admiration.”

Dr. Cortés complimented the Department of Public Works on the publication of its monthly magazine, CALIFORNIA HIGHWAYS AND PUBLIC WORKS.

“The magazine, which we receive in Costa Rica and also in Nicaragua, has been of great help to our highway engineers,” Dr. Cortés said.

The former president of Costa Rica was minister of public works of his country from 1929 to 1936, in

3,618,818 Miles of Highways In the America Republics

THE total road mileage in the 21 American Republics is 3,618,818 miles. Argentina leads outside the United States with 253,115 miles of highways and 275,300 automobiles. Brazil is second with 129,057 miles and Mexico third with 56,923 miles. The United States has six times the combined road mileage of the other 20 Republics with 3,056,000 miles.

Argentina is making the most progress of any of the South American Republics in road building since the government in 1933 passed the Highway Act which provided for the National Highway Bureau and Federal Aid, patterned in many respects after the Federal Highway Act of the United States.

Road construction in Central America is progressing slowly. Guatemala and El Salvador may now be crossed by automobile. This year Nicaragua planned to build 125 miles of main road.

Cuba, with 43,852 automobiles, leads with a ratio of 19.1 automobiles to 1 mile of road. Panama and the Canal Zone are second with 9.7. Argentina, with the greatest road mileage outside of the United States, has 1.1 automobiles to a mile of road.

Some idea of the condition of roads in South America is shown in a report of the United States Department of Commerce which indicates that Paraguay, with only 3,759 miles in its present highway system, has 30 miles of roads improved with gravel surface, the remaining mileage coming under the heading of unimproved earth roads, and yet Paraguay has 1,526 automobiles.

—*Highway Highlights.*

which year he was elevated to the presidency.

While in Sacramento, Dr. Cortés and party were escorted through the Division of Highways shops, and the Testing and Research Laboratory by Leo J. Smith of the Department of Public Works, who assisted the visitors in arranging their itinerary in northern California.

Steel Guard Rail Installed Along 46 Miles of Monterey Coast Road

By L. H. GIBSON, District Engineer

A CONTRACT was entered into with the Union Paving Company in July of this year for what is perhaps the largest installation of guard rail ever placed on a California State highway under one contract. This installation on the Roosevelt Highway (State Sign Route 1), between San Luis Obispo and Monterey, is now practically complete. The new guard rail presents a very pleasing appearance as well as high visibility and affords unusual protection.

The contract extends from the San Luis Obispo County line northerly 46.6 miles to the Big Sur River, about 27 miles south of Carmel. The total cost of the contract will be in the neighborhood of \$80,000, which sum was set up in the current budget to be paid out of State Highway Funds. The northerly $\frac{3}{4}$ of a mile is within the boundaries of the Big Sur State Park.

In addition to the guard rail installation, points of less hazard have been protected by installation of guide posts. The total mileage of guard rail and guide post protection covers 30.2 roadside miles.

During the summer months the traffic will average between 700 and 1100 cars in a 16-hour day, and the estimated traffic in 1965 will be 1410 cars per day. This is mostly passenger car traffic with only one to two per cent of truck traffic, which percentage is very much lower than on the general main traveled arteries. Traffic during winter months is considerably less.

Because of the nature of the terrain which on this portion of the Roosevelt Highway is very precipitous, a car leaving the road at some places may fall hundreds of feet. Consequently, the necessity for guard rail is very evident and further consideration was given to the selection of a type of rail which would give the greatest protection possible. A beam

type of metal rail was finally selected as best adapted to the conditions.

The rail is supported only through steel brackets attached near the bottom of the wooden posts. This gives a great resiliency to the railing which tends to absorb the impact of a car hitting the rail without the usual breakage that occurs with more rigid types. This spring action also tends to throw the car back into the road without upset or other than minor damage.

A description of the guard rail as installed is as follows: Redwood or cedar posts 8 by 8 inches in section and 6 feet long were set into the ground 3 feet 6 inches and to this post was bolted a steel spring bracket 7 16 inch in thickness and 4 inches wide and curved to fit the rail section and to hold it approximately 5 inches away from the post at the top. This bracket which has a tensile strength in excess of 100,000 pounds per square inch is fastened to the post with two galvanized bolts near the ground surface. The railing which is 12 inches wide after forming and is a minimum of $\frac{5}{32}$ of an inch in thickness has a tensile strength in excess of 80,000 pounds per square inch. The edges of the railing are rolled to remove any sharp edges which might be dangerous to car or passenger in case of accident. These rails are 10 feet long and are bolted together at each end and the railing bolted to the steel bracket with two galvanized bolts.

The steel brackets and steel rail are given a shop coat of red lead before reaching the job and after installation are given another coat of red lead and two coats of white paint. The paint is particularly selected for its protective qualities, as steel in this ocean area deteriorates very rapidly unless properly protected. The redwood or cedar posts are given three coats of white paint.

In addition to the protection afforded by the guard rail, guide posts

3 by 8 inches by 5 feet 4 inches long were placed in areas which were considered less hazardous but where, on account of occasional fog conditions, marking of the roadside edge was quite essential. These guide posts were also given three coats of white paint and were spaced approximately 50 feet apart measured along the centerline of the highway.

The State obtained very satisfactory bid prices for rail and guide posts considering the rocky material encountered in digging post holes and the location of the work. The guard rail contract price is \$1.09 per lineal foot of rail and the guide posts are \$1.75 each, in place. 63,662 lineal feet, or approximately 12 miles, of guard rail are being installed on the 46.6 miles in 294 different locations; 3,649 guide posts are being placed in 289 locations and cover about 18 roadside miles. In the contract additional guard rail, complete with posts, brackets and railing, and a quantity of guide posts were furnished and stored at the two Maintenance Stations within the limits of this contract so that quick repairs or replacements could be made on any section damaged by motor vehicles or other causes.

Of the above length of guard railing, 1000 feet were left unpainted by the contractor according to the terms of the contract to permit investigations and experiments by the Division of Highways laboratory to determine the types of paint considered best suited to the protection of steel work adjacent to the ocean where fog and salt spray tend to rust and deteriorate any type of steel work. The experimental painting was performed by State forces.

The section of road on which this protection is being placed was graded 20 to 24 feet wide, generally by convict labor, from 1922 until 1937 when the road was finally opened to traffic.

(Continued on page 28)



Views on Monterey Coast Highway between San Luis Obispo County line and Big Sur showing installations of steel guard rail



From top to bottom—Ave. 43 bridge over Freeway and channel. Service road bridge over channel in left background. Grand Ave. bridge, Arroyo Dr. bridge in background. Ave. 40 bridge over Freeway and channel. Arroyo Dr. bridge over Freeway in S. Pasadena

Arroyo Seco Required 26

CONSTITUTING the third unit of the Arroyo Seco Parkway connecting Los Angeles and the city of Pasadena, an additional mile of this famous freeway was opened to traffic on November 1.

The completion of this section from Avenue 22 to Avenue 40 opens up 5½ miles of the six-mile project which starts at the east end of the Figueroa Street Bridge across the Los Angeles River in Los Angeles and ends at Glenarm Street in Pasadena.

Since Figueroa Street is the major origin of north-bound traffic using the Parkway, its present condition constitutes a bottleneck and restricts the free and uninterrupted flow of traffic from the Los Angeles downtown area through the Parkway. At the present time surveys and studies are being made for an additional roadway northwest of and roughly parallel to the existing North Figueroa Street.

This project, which was described in the last issue of California Highways and Public Works, will extend southwest from Avenue 22, on the east side of the Los Angeles River, cross the river, and continue through Elysian Park to Castelar Street, a distance of about one mile. The new road will carry south-bound traffic only, while the existing road will carry only north-bound traffic.

FOR RAPID TRAFFIC MOVEMENT

Tentative plans require the construction of five bridges on this Figueroa Street extension project: a bridge across the Los Angeles River parallel to the present structure approximately 850 feet long; one to carry a park road situated within Elysian Park over the proposed new roadway approximately 200 feet long; another 200-foot bridge to carry the new roadway over Solano Street; an 80-foot structure to carry the new roadway over Bishop Road, and a bridge approximately 230 feet long to carry a new road connected to Castelar Street over existing Figueroa Street.

In the construction of the Arroyo Seco freeway every consideration was

Freeway Project Bridge Structures

given to providing means of facilitating rapid movement of traffic. All highway, pedestrian, and railroad cross traffic at grade has been eliminated. The motorist will not encounter a boulevard stop sign or an automatic traffic signal in the entire length of the freeway. To accomplish this required the construction of 26 grade separation structures of various types at the following locations:

PROJECTS AND COST

In Los Angeles

Projects	Cost
Avenue 22 Bridge.....	**\$165,000
Avenue 26 Bridge.....	42,300
Cypress Avenue (Abutments and Foundations for Future Bridge).....	164,000
Avenue 35 Railroad Bridge.....	120,000
Pasadena Avenue Bridge.....	190,000
Avenue 43 Bridge.....	45,100
Avenue 43 Ramp Bridge.....	5,700
Sycamore Grove Pedestrian Bridge.....	30,400
Avenue 52 Parkway Bridge	**195,400
Avenue 52 Channel Bridge	
Hermion Avenue Parkway Bridge	
Hermion Avenue Channel Bridge	18,400
Avenue 60 Service Road Bridge	
Avenue 60 Bridge.....	
Marmion Way Bridge	58,000
Marmion Way Service Road Bridge	

South Pasadena

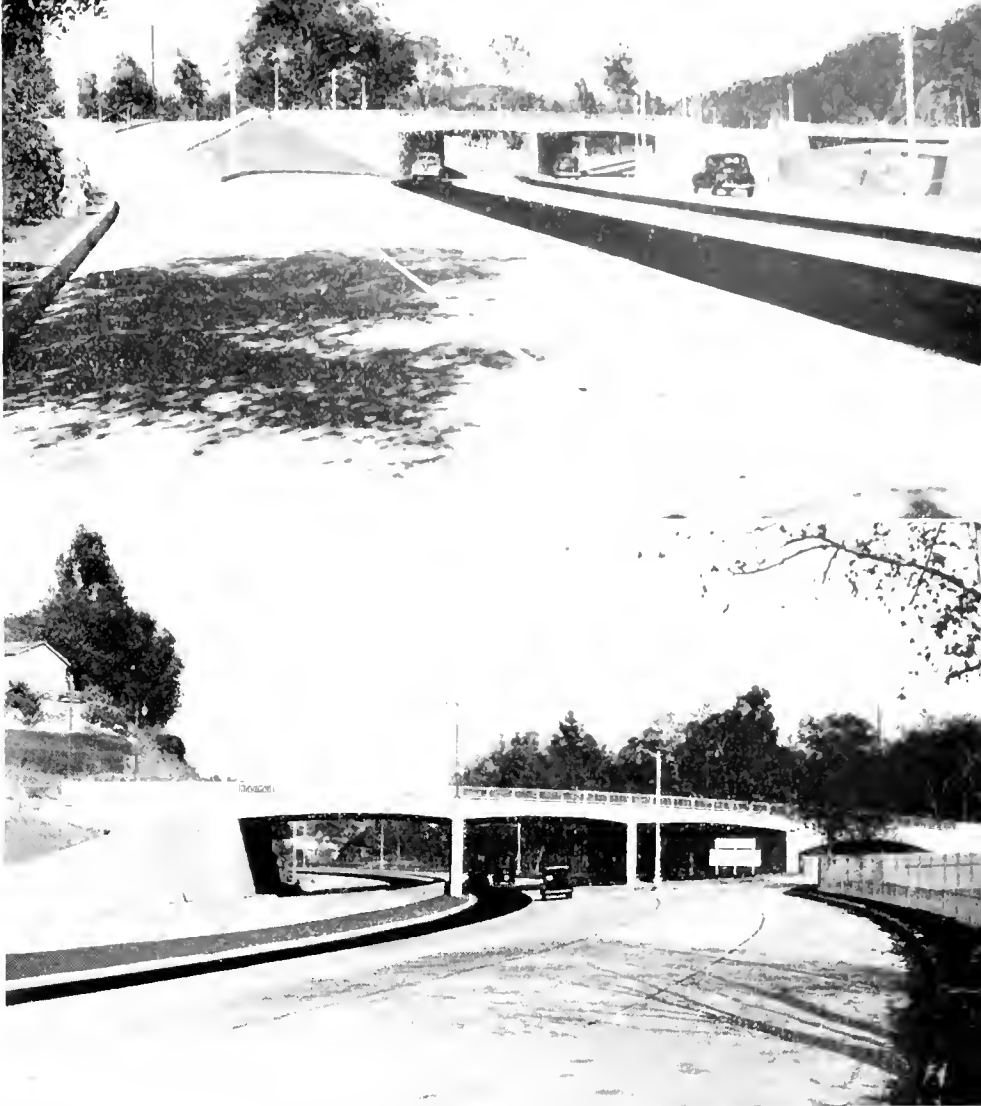
Hough Street Bridge.....	135,000
Arroyo Drive Bridge	**111,100
Equestrian and Pedestrian Underpass	
Grand Avenue Bridge	
Orange Grove Avenue Bridge	20,200
Prospect Avenue Bridge	23,600
Meridian Avenue Bridge	
Fremont Avenue Underpass	154,500
Fremont Avenue Bridge	
Fair Oaks Avenue Bridge.....	50,400
	\$1,588,300

** Includes Roadwork.

The detailed plans of these structures were designed cooperatively by the Los Angeles City Engineering Department and the State Division of Highways, and the structures themselves were built under the supervision of the Bridge Department of the Division of Highways of the State of California.

Several of the projects include extensions to former structures over the

(Continued on page 19)



Top—View of Ave. 52 bridge over Freeway and Arroyo Seco channel. Center—View of Marmion Way bridge crossing over Freeway and channel. Lower—Hermion Ave. bridge over Freeway. Bridge over channel is shown on right side of picture behind fence.

Reconstruction of 19th Avenue In San Francisco By Gas Tax Funds

By GEORGE MATTIS, Engineer, City and Cooperative Projects, District IV

STATE Highway Route 56, which is California Sign Route No. 1, will become, in the ordinary course of events, one of the major routes of recreational travel throughout the length of the State, traversing as it does the Pacific Ocean shore line from Santa Barbara County to Humboldt County.

While this route will be used more for its recreational features than for through travel, it will greatly contribute to the development in a commercial way of the country along its route. The Division of Highways in cooperation with Santa Cruz County,

San Mateo County, and the City and County of San Francisco, have been reconstructing State Highway Route 56 between San Francisco and Monterey Bay during the past several years as funds became available. The entire length of this route within the City of San Francisco has been reconstructed and widened to modern standards.

This route enters the City of San Francisco on Junipero Serra Boulevard, at the city limit line between San Francisco and Daly City. It follows Junipero Serra Boulevard to its intersection with the Nineteenth Ave-

nue Extension, and thence over the Nineteenth Avenue Extension and Nineteenth Avenue to the Golden Gate Park.

Through the Park, no street has been officially designated by the Division of Highways as State Highway Route 56; however, the Golden Gate Park authorities, in cooperation with the W.P.A. authorities, constructed a divided roadway through the Park, from Nineteenth Avenue at Lincoln Way to Fulton Street at Park-Presidio Boulevard.

From this point, this route uses Park-Presidio Boulevard to the south-



Views on Nineteenth Avenue, San Francisco, before (upper) and after (lower) widening of pavement and setting back of residences



Looking north on Nineteenth Ave. across Taraval St. in San Francisco before (upper) and after (lower) thoroughfare was widened

erly line of the Presidio Military Reservation near Lake Street, and thence over the newly constructed Funston Avenue Approach to the Golden Gate Bridge, described in the March and May 1940 issues of this publication.

The territory in San Francisco traversed by State Highway Route 56 is through the westerly portion of the city and is through a highly developed residential district. Southerly of Sloat Boulevard a large territory is rapidly being developed for a residential district, and for the past several years new homes have been under construction at all times. This development will, of course, increase the local traffic desiring to use State Highway Route 56 to reach not only the outlying districts but also to reach the business section of San Francisco by way of the Portola-Market Street arterial, or by way of the newly constructed Golden Gate Bridge approach and Lombard Street.

NINETEENTH AVENUE WIDENED

The reconstruction of State Highway Route 56 on Nineteenth Avenue, between Sloat Boulevard and the Golden Gate Park at Lincoln Way and on Park-Presidio Boulevard from Fulton Street to the Presidio, was

financed entirely from the $\frac{1}{2}$ allocation for State Highways in the City of San Francisco. The entire project was designed by the Engineering Department of the Department of Public Works of the City of San Francisco, under the supervision of City Engineer John J. Casey, and was approved by the State Division of Highways.

The alignment followed the lines of Nineteenth Avenue from Sloat Boulevard to Golden Gate Park, but the widening was done in such a manner as to avoid the destruction or moving of the larger buildings. The method of alternately widening on opposite sides would ordinarily have caused an irregularity in the alignment, but at the suggestion of District Engineer Jno. H. Skeggs, full advantage was taken of the high summits and of the topography of the district traversed, and no one driving along this highway is conscious of any irregularity in the alignment of the roadway. This deviation in direct alignment, however, did permit of a great saving in the total cost of this project by avoiding the destruction of expensive apartment houses and other important structures.

Nineteenth Avenue was widened from a width of 70 feet to a width of 100 feet between property lines. On

this right of way there were constructed two roadways having a total width of 38 feet each between curbs; a center dividing strip 5 feet in width; and portland cement concrete sidewalks 9½ feet wide on each side of the street. Roadways were paved with a portland cement concrete pavement 8 inches in thickness. The traveled way was surfaced with an asphaltic pavement 31 feet in width and 2 inches in thickness. This section is 2.18 miles in length.

The additional right of way required to provide for the widened section cost \$764,355. The work was done under public contract at a total cost, including engineering, of \$534,865. The total cost of the Nineteenth Avenue portion is therefore \$1,299,220. This project was divided into four contracts of approximately one-half mile in length each. The Fay Improvement Company was the contractor on one section and Charles L. Harney on the other three sections.

On Park-Presidio Boulevard, the alignment followed the lines of the then existing roadway from Fulton Street to the Presidio. This boulevard passes through the center of a planted city park, parallel to and between Funston Avenue and Fourteenth Avenue.



Looking north on Park-Presidio Boulevard, San Francisco, before (upper) and after (lower) new divided pavement improvement

WIDE ROADWAY

Originally this section was paved with an oil macadam pavement 50 feet in width. The new pavement was extended $2\frac{1}{2}$ feet on each side into the Park area, and two portland cement concrete roadways were constructed 24 feet in width each and 8 inches in thickness. No parking is permitted on these roadways. They were surfaced with 2 inches of asphaltic concrete pavement. A dividing strip 5 feet in width was constructed on the center line.

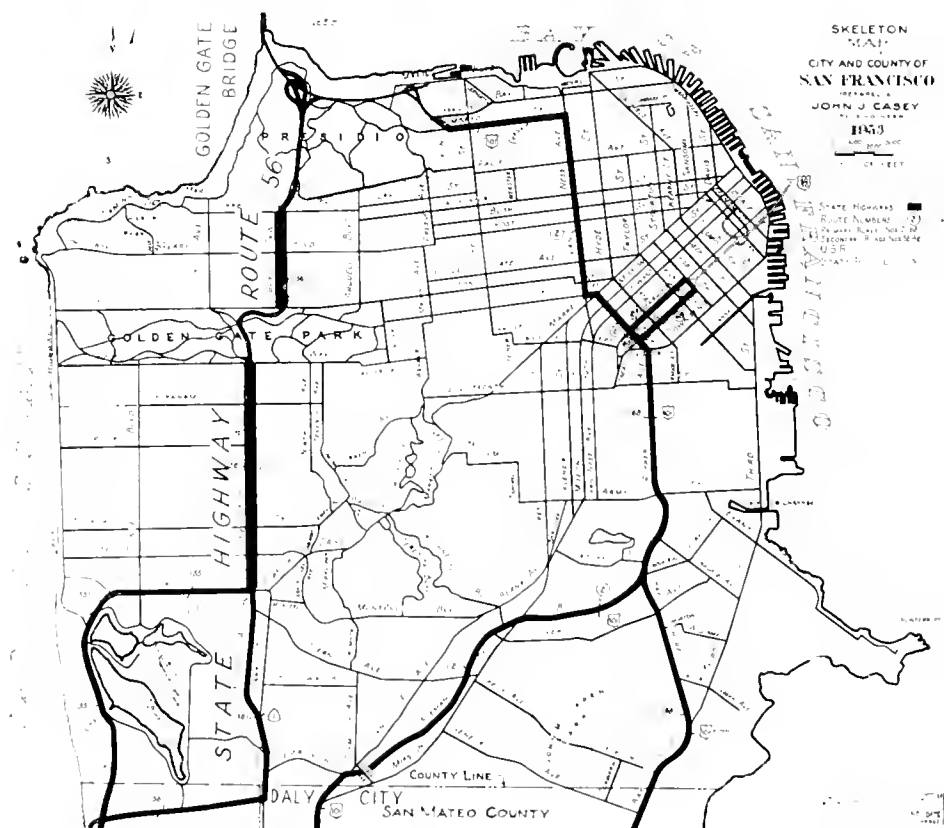
The total width from the westerly property line on Funston Avenue to the easterly property line on Fourteenth Avenue is 240 feet. The Park-Presidio Boulevard is constructed in the center of this 240 foot wide park. The footpaths on each side of the roadway were not disturbed by the new construction. There is a bridle path between the new roadway and Funston Avenue, which also was not disturbed by the new construction. The length of the improvement from Fulton Street to Lake Street is just one mile. The total cost of this improvement, including engineering, was \$147,890. Charles L. Harney was the contractor on this section.

The total cost of the reconstruction of State Highway Route 56, financed from the $\frac{1}{4}$ State Highway Fund, for these two projects is \$1,447,110.

The officials of the Division of Highways are well pleased with the hearty cooperation of the Engineering Department of the city in the preparation of the plans and specifications,

and in the construction standards prescribed for this project, which were in conformity with the standards maintained by the State.

(Continued on page 25)



Arroyo Seco Project Required 26 Structures

(Continued from page 15)

Arroyo Seco Channel to provide crossings over the adjacent Parkway. A similar type of construction was used in making an extension or addition to these structures so that the whole system would provide a uniform and pleasing appearance.

Completely new structures incorporate the latest methods of modern design standards. Many of these are of the rigid frame concrete type which allows for the construction of longer spans and provides a maximum of under-clearance with a comparatively smaller variation in grades of the separated roadways. Aesthetics and economy were given foremost consideration in the design of all the structures. Simplicity and grace in line result in harmony throughout.

RAILROAD CROSSINGS

There are two locations on the Parkway which will be crossed by the Union Pacific and Santa Fe Railroads. At Avenue 35 there is a double track railroad structure 260 feet in length with a 113-foot channel span and roadway spans of 75 feet and 68 feet. The superstructure is a continuous steel girder design. During construction the Union Pacific and Santa Fe railroads operated over a 300-foot timber shoofly trestle.

At Fremont Avenue another railroad structure is provided for both the Santa Fe and Union Pacific tracks across the Parkway. It is a double track structure with a steel girder span of 140 feet. The girders for this structure, a total of three, were assembled completely in the shop and hauled to the job at night by truck and trailer while traffic density was at a minimum. These girders are 140 feet long, 10 feet deep, and weigh 67 tons each.

At Fair Oaks Avenue a double track bridge over the Freeway is being provided for the Pacific Electric Railway in conjunction with the vehicular structure.

Included in the Arroyo Drive and Grand Avenue project was the construction of an equestrian and pedestrian tunnel. This structure is 168 feet long with an inside width of 16

October Traffic on State-Owned Bridges Maintains High Level

TRAFFIC on the San Francisco-Oakland Bay Bridge during October continued to be very high even though the Golden Gate International Exposition is no longer operating.

During the month 1,424,822 vehicles used the span.

Coincident with the acquisition of the Carquinez and Antioch bridges by the State on September 16, tolls

on these structures were reduced on most vehicle classifications. While it is too early yet to determine definitely the effect of these reductions on traffic, it is quite clear that there has been a substantial increase in volume.

October traffic on the San Francisco-Oakland Bay Bridge and the Carquinez and Antioch bridges is tabulated below:

	San Francisco- Oakland Bay Bridge	Carquinez Bridge	Antioch Bridge
Passenger autos and auto trailers-----	1,302,766	251,192	15,539
Motorcycles and tricar-----	4,769	870	125
Buses-----	19,362	4,555	193
Trucks and truck trailers-----	74,501	23,325	4,151
Others-----	23,424	106	16
Total Vehicles-----	1,424,822	280,048	20,024

feet and a clear height of 10 feet, 7 inches. Automatic lighting facilities are provided.

Of the 26 structures on the Parkway, 17 of them carry traffic of one form or another over the Freeway, 13 are for vehicular traffic only, two for railroad traffic only, one for pedestrian traffic only, and one carries both vehicular traffic and two tracks of the Pacific Electric railroad. The equestrian and pedestrian tunnel is the only structure under the Freeway.

There are 12 new structures over the Arroyo Seco Channel, five of them contiguous with the aforementioned bridges over the Freeway. The other seven structures are entirely independent and only span the channel.

Avenue 26 and Avenue 60 Bridges over the Freeway are extensions to bridges which spanned the Arroyo Seco Channel prior to construction of the Freeway.

The Cypress Avenue project consists of abutments and foundation construction only for a future bridge consisting of two 35-foot lanes to carry traffic over the Freeway.

Out of the total cost of approximately \$12,000,000 for the entire Arroyo Seco Parkway project, the structures will cost about \$1,600,000. This figure includes some incidental road work included in three of the bridge contracts.

Obviously a project of this magnitude, however desirable, could not be financed by a single agency. The State's 1½ cent gas tax fund must be used in the maintenance and construction of approximately fifteen thousand miles of primary and secondary roads. Nor could the city or county of Los Angeles shoulder the entire fiscal responsibility. The project therefore was financed by joint contributions from funds of the city of Los Angeles, the city of South Pasadena, and the State and Federal Governments. The financing, planning, preliminary investigation, design, and construction of a project combining so many units and involving so many operations required complete coordination of all the interested agencies.

The utmost cooperation was required among the various cities and the State to plan and coordinate work so that each grade separation structure would tie in with ultimate plans favorable to all concerned. The problem of moving the many facilities owned by public utility companies is one example of the details involved. Provision had to be made for moving these facilities to other locations or for installing conduits, etc., for carrying them on or through the structures.

San Jose Subway Eliminates 9-Track Railroad Grade Crossing

By J. E. BURKE, Resident Engineer

IN the city of San Jose, Polhemus Street has long been one of the most heavily traveled arterials in the northern part of that Santa Clara County city, due to the fact that it is the only street which provides a direct cross-town connection between El Camino Real (U. S. Route 101) and the Bayshore Highway (Route 101 Alternate). All other streets north of Santa Clara Street either stop at the Southern Pacific tracks or at Guadalupe Creek and traffic using these streets is required to make numerous right angled turns in order to find existing grade crossings over the tracks or bridges over Guadalupe Creek.

Polhemus Street, however, crossed nine tracks of the railroad at the north end of the San Jose yards. Over these tracks, daily, pass eighty-odd

scheduled passenger trains—about half of which cross Polhemus during the peak vehicle traffic hours of 6 to 8 a.m. and 4:30 to 7:00 p.m.

In addition there are numerous freight schedules per day and many switching operations. Thus, delays to Polhemus Street traffic were frequent and lengthy and made the grade crossing a dangerous one.

RAILROAD COOPERATES

In 1924 the officials of the city of San Jose instigated the construction of a grade separation on this arterial. By 1927, negotiations had progressed to the point of active cooperation with the Southern Pacific Company. However, a few years later, the tentative plans which had been formulated were shelved.

With the advent of the Federal

Aid Grade Separation Funds for Feeder Roads, the city of San Jose again proposed Polhemus Street as worthy of consideration. Federal funds were advanced for the work and plans and specifications were drawn by the Bridge Department of the State Division of Highways. On January 17, 1940, Contractor Earl W. Heple of San Jose submitted a low bid of \$130,497.40 for the construction of a subway at this location and was awarded the contract.

Work embraced under this contract provided for carrying the nine tracks of the railroad on an overhead structure consisting of 24-inch steel beams, supported by reinforced concrete abutments on spread footings on cast-in-place concrete piles. During construction operations, two of the nine tracks were removed but the other



View of Polhemus Street Crossing in San Jose before improvement where highway crossed nine tracks used by eighty trains daily



New Polhemus Street underpass in San Jose eliminating dangerous railroad grade crossing on heavy traffic highway arterial

seven were kept available to the movement of railroad traffic at all times except during the construction of the temporary timber railroad trestle.

ONLY SHORT INTERRUPTIONS

While driving the temporary trestle piles and setting the caps, stringers and decking and while setting the structural steel, one track at a time was removed from service for short periods. The work of erecting and removing the trestle, of setting structural steel and of arranging tracks, switches and signal facilities was done by the railroad company equipment and forces under an agreement with the State at an estimated cost of about \$48,000.

Included in the railroad's estimate was a figure of approximately \$6,000 for the driving of 161 steel shells for foundation piles under the seven tracks in operation. As the temporary trestle construction progressed, it became apparent to the engineers that, considering the volume of train operations per day and the design of the trestle, it would be impossible for the railroad crews to drive these shells either within a reasonable length of time or within the amount of money estimated by them for the work.

In order that the railroad crews and equipment might perform this work, it would have been necessary to shift or remove the ties, rails and timber stringers to allow driving each

shell in the position shown for it on the plans. A follower would also have been necessary to secure proper penetration and bearing of shells and, as these shells were not the type which uses a mandrel, it was feared the process would be slow and awkward. Peak driving under these conditions was estimated to be not over seven shells per eight-hour shift.

SHORT PILE HAMMER LEADS

After numerous suggested methods had been advanced, it was decided to drive the shells from under the trestle, by constructing a special set of short leads for the pile hammer. An extra work order of approximately \$4,800 was issued in favor of Contractor Heple. The special set of short leads was made and attached to a one and a half yard rig with a short crane boom. As vertical clearance between footing and the bottom of the trestle stringers was only about 22 feet, and as the double acting steam hammer used took up about nine and a half feet, it was necessary to drill eight to ten feet with post hole augers, set the shell into the hole and spot the leads and hammer over it. With this method an average of 40 shells per eight hour shift were driven. Approximately \$1,200 and 19 eight-hour shifts of labor were known to have been saved.

The completed structure provides a 26-foot clear roadway through the abutments, flanked by 4-foot side-

walks on each side. An additional 11-foot lane for vehicular traffic is provided on either side of the structure proper for traffic ascending from the depressed portion. At the Stockton Avenue intersection, two triangular-shaped traffic islands were constructed, providing one 11-foot lane each way for traffic either entering or leaving Stockton Avenue.

Four-inch-thick concrete slope paving slabs were constructed on all cut slopes. Perforated pipe underdrains under the portland cement concrete pavement and slope paving provide for stable subgrade conditions. Adequate catch basins and other drainage facilities take care of the roadway drainage. All drainage flows into a sump at the southeast corner of the structure, whence it is pumped by either of two alternating centrifugal pumps into a 24-inch storm sewer of the city's system.

The steel beams supporting the nine tracks of the railroad are hidden from view by reinforced concrete fascia beams which span the abutments at each end. On the inner side of the fascia beams shelves are provided which carry one side of a "multigrip" walkway plate that spans the space between the steel and fascia beams.

Stockton Avenue, at its intersection with Polhemus Street, was lowered approximately two feet. This necessitated the resurfacing with asphalt

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Looking up new Clarksville grade on the realignment of U. S. 50 between Folsom and Placerville

Realignment of U.S. 50 Reduces Curves and Miles East of Folsom

By H. F. SHERWOOD, Assistant District Office Engineer

THE new section of U. S. 50 highway between three and three-fourths miles east of Folsom and two and one-fourth miles east of Clarksville which has been under construction during recent months, was opened to traffic late in October. The new unit is a portion of State highway Route XI and a link in the connection between the populous San Francisco Bay and Sacramento Valley regions and the Lake Tahoe and American River Canyon recreational areas.

The old road between Sacramento and Placerville was constructed between 1915 and 1920 and was naturally designed to serve travelers who considered 35 miles per hour to be a high speed. The short radius

curves, which were not particularly objectionable at these lower speeds, constituted definite hazards when higher speeds became usual and this road is being reconstructed to modern standards as fast as money becomes available.

The new road throughout this section consists of a plant-mixed surfacing 22 feet wide by 0.21 of a foot thick on a crusher run base 23 feet by 0.4 of a foot. The project was designed on the basis of a minimum passing sight distance of 1600 feet, except at a few locations where the character of the terrain made modifications necessary.

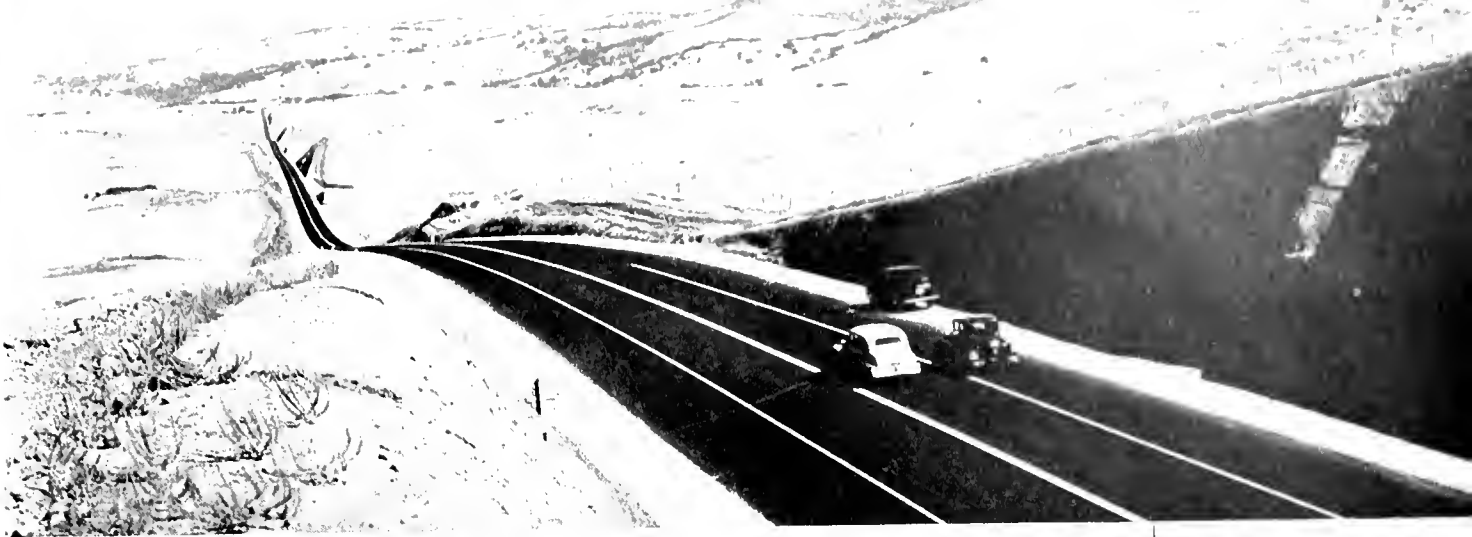
In order to enhance the safety of the project at the vertical curve near Station 350 where one such modifi-

cation was required, four traffic lanes were provided. Four lanes were also constructed at the one grade crossing on the project. This grade crossing is protected by flashing light signals.

There were many short radius horizontal curves, some with radii as short as 100 feet, and many sharp vertical curves with very limited sight distance.

The narrow width and poor alignment and grades made the old road entirely inadequate to meet the traffic requirements of the larger number of cars and the higher speeds which now prevail.

During the summer months the ordinary commercial and passenger traffic between Sacramento and Placerville is greatly augmented by



Top and bottom pictures of U. S. 50 realignment east of Folsom show where 4 lanes were provided to enhance safety on vertical curves. Center picture is view of a cut through solid rock where blasting was necessary



East of Clarksville the new straight route, eliminating numerous sharp curves, affords excellent sight distance

an increasing amount of travel to the American River and Lake Tahoe recreational areas. Due to the increasing popularity of snow sports during the past few years the winter traffic has also increased.

The minimum radius of curvature is 1,500 feet except at the connections to the old road and the maximum grade rate is 7 per cent. The new alignment is much more direct than the old, resulting in a distance saving of about 1.9 miles. The total length of the new project is 5.84 miles.

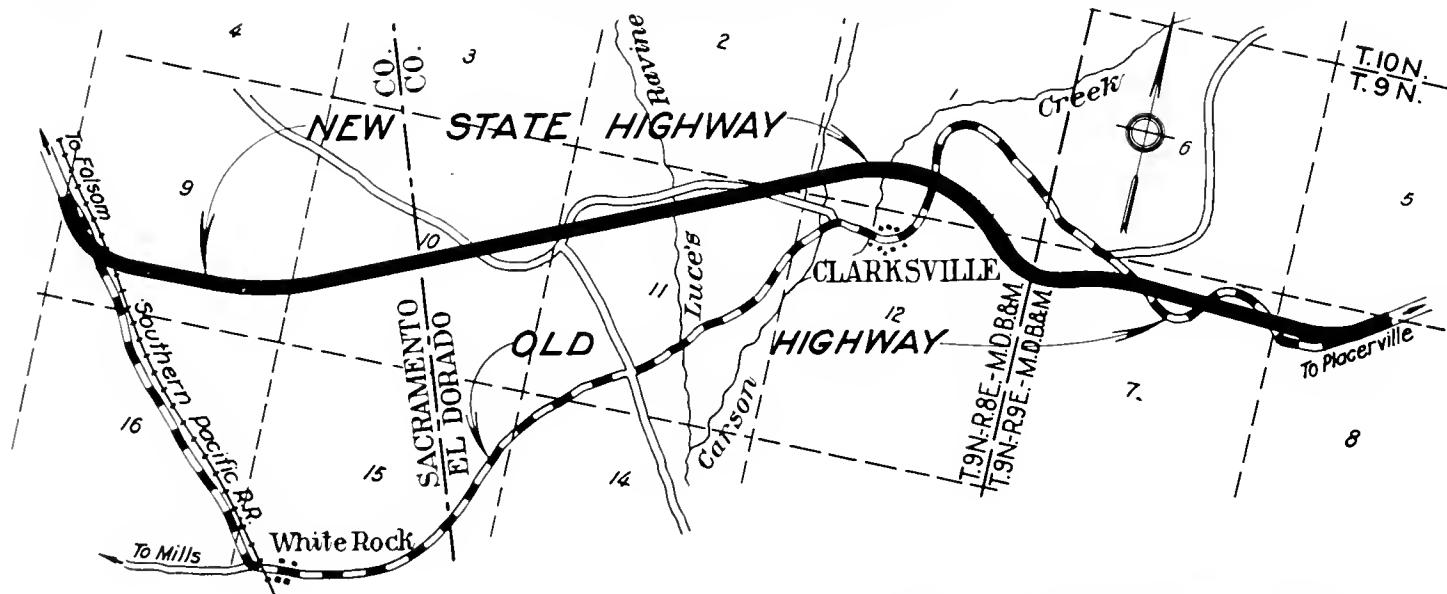
The contrast in standards used on the old road and new road is brought out both in the table below and the map showing the location of the project.

	Length	Minimum Rad. of Curvature	Total Curvature	Maximum Grade
Old Road	7.75 mi.	100 ft.	1653° 21'	7%
New Road	5.84 mi.	1,500 ft.	304° 02'	7%

The construction of this project required the moving of about 400,000

cubic yards of material, part of which was solid rock. Wherever possible excavation was done by tractors and large carryalls. In rock cuts, blasting was done where necessary, the material being excavated by power shovels and hauled by five-cubic yard dumpsters. These dumpsters were close coupled for easy handling and the body so balanced that when a catch was tripped the load was dumped by gravity. They were capable of comparatively high speeds over short distances and

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Operation of State Toll Bridges

By RALPH TUDOR, Principal Bridge Engineer

ON September 16, 1940, the California Toll Bridge Authority purchased the Carquinez and Antioch toll bridges, and the responsibility for operating and maintaining the two structures was given to the San Francisco-Oakland Bay Bridge organization of the Division of Highways. By thus consolidating the work, it will be possible to realize many economies and at the same time gain the advantage of uniform public relations on these State owned and operated bridges.

While the general supervision and much of the detail work will be carried on at the Administration Building of the Bay Bridge, the detailed residence supervision of these two structures will be handled from the office of the Carquinez Bridge. This assignment has been given to Mr. C. R. Davis, Associate Bridge Engineer. A force of toll collectors, an office personnel, and a small maintenance organization are under his immediate control. The heads of the various departments of the San Francisco-Oakland Bay Bridge have been assigned the supervision of the corresponding departments on the other bridges; however, in all cases this supervision is exercised through Mr. Davis. In this manner the immediate administration is reinforced with

adequate and proper authority. The toll collection forces for these bridges are now being finally organized. This has involved the training of new collectors and the school work involved has been carried on at the Bay Bridge under the observation of the experienced staff on that structure. As the new collectors have become familiar with handling toll registers, scales, and other equipment, and have learned to work efficiently and courteously with the heavy volume of traffic that crosses these bridges, they have been given their permanent assignments.

Only the very minimum of accounting is done outside the Bay Bridge office. At each bridge the cash is counted and deposited and the traffic records compiled. All billings for credit charges are made up and mailed from the Bay Bridge. All requisitioning of supplies, preparation of payrolls, and bookkeeping is likewise conducted here.

There will be a minimum of maintenance personnel kept continuously on the Carquinez and Antioch bridges. For the present this will be sufficient to handle emergencies only but a small regular paint force will be organized later. All other work that is not handled by contract or service agreement will be accom-

plished either by temporary assignment of men from the Bay Bridge or by sending the work to the Bay Bridge shops.

A physical inspection of the bridges at the time of acquisition showed them to be in generally good condition. The Carquinez Bridge is in an especially good state of repair and, outside of a nominal amount of spot painting and a few repairs around the toll plaza, there is little that needs to be done. At the Antioch Bridge some repairs will be necessary in connection with the reinforced concrete approaches. Also, many of the piles in the dolphins and pier fenders must be replaced. The most important change planned at this structure is a new toll plaza. Heretofore there has been a small booth located on the lift span. The bridge is so narrow that this booth must be shifted from side to side to accommodate loaded trucks. Furthermore, although the toll schedule has been and is still based upon weights, there have been no scales. The tolls for trucks have generally been arrived at by guess and by compromise. This method is quite unsatisfactory and to correct it a small toll plaza with scales is planned to be placed on the highway adjacent to the south end of the bridge.

Realignment of U. S. 50

(Continued from page 24)

were found to be very satisfactory on the type of work for which they were used.

Compaction in addition to that secured by the usual watering and rolling was secured by routing the heavy carryalls over all portions of fills on which they were working.

Hemstreet and Bell, the contractors on this project, made good progress and were able to complete the work about a month before the specified completion date, at a total cost of approximately \$241,000. The resident engineer for the State was Mr. J. W. Corvin.

Drainage facilities required were

mostly of standard types. There were several springy areas within the limits of the project where perforated metal pipe underdrains were provided to care for the drainage. During construction several more areas of this type were encountered and it has been necessary to increase the amount of underdrain construction considerably.

At the crossing of Carson Creek, after a comparative study of several types of structures, it was decided that the most economical installation would be a triple 10-foot by 10-foot reinforced concrete box culvert, 103 feet in length. Due to the excellent foundation conditions, it was possible to eliminate the customary bottom slab in designing this structure.

Reconstruction of 19 Ave. in San Francisco

(Continued from page 18)

The travel on State Highway Route 56 in San Francisco since it was reconstructed has increased to such an extent that the city authorities, in co-operation with the Division of Highways, have found it necessary to develop plans for facilities to provide relief for the congestion now experienced at pivotal points. A comparison of the traffic now passing through intersections on this route with that of 3½ years ago indicates the increasing use of this route and development and occupancy of the western portion of the city.



The grade descends by easy curves to the Coachella Valley desert floor between Palm Springs and Indio

Highway From Palms to Pines

By A. EVERETT SMITH, Assistant Highway Engineer

THE scenic Palms to Pines Highway (State Route 64) was for years a vision in the minds of progressive citizens of Riverside County. Due to their efforts it is now a reality of the most vivid sort. It branches from the Palm Springs-Indio Highway at a location adjacent to the precisely groomed date palm gardens of the upper Coachella Valley. From an elevation of 230 feet above sea level it bears southerly on a straight line for about three and one-half miles across alluvial plains rising to the foot of the mountains at Dead Indian Creek. Meeting the mountains, the highway winds its way over the steep rocky and cactus covered slopes, by means of sweeping curves that admit of comfortable riding.

Along this portion of the highway

from the turn-outs provided at vantage points are vivid panoramic views of the distant broken mountain ranges, the deserts and farms and the Salton Sea in the Coachella Valley below.

Still ascending, but on a less severe alignment, it parallels Deep Canyon, passes through Pinon Flats, swings past the Santa Rosa Mountains, through the Santa Rosa Indian Reservation and over a summit at an elevation of 4980 feet. This summit divides the water sheds of the Salton Sea and the Pacific Ocean.

From here the highway leads through the Hemet Valley, past Lake Hemet and on until it meets the Idylwild National Forest Highway at the Idylwild Resort Junction.

This end of the highway is through

forests studded with large pines and completes the name "Palms to Pines."

Varied is the scenery and numerous are the attractions along this drive. San Jacinto Mountain to the north, at an elevation of 10,800 feet, precipitously slopes to the floor of the desert at Palm Springs. Fine cattle range on adjacent pastures. A side road leads to Ramona's grave. Hunting areas annually attract numerous sportsmen. Tree covered mountains, rugged ranges, deep canyons and the desert all offer attractions to this route.

Unlike many a road that began as a trail and grew up to be a highway, this one was originally located and constructed under engineering supervision through relatively undeveloped

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Scenes on route of Palms to Pines Highway from mountains to desert. At top, a beautiful piece of divided highway out of Hemet.
 Center—Picturesque rock formations on grade. Bottom—Flowering trees border road

October Highway Bids and Awards

AMADOR COUNTY—Between Ione and 2.0 miles southerly, about 1.6 miles to be widened and surfaced with plant-mixed surfacing over gravel base. District X, Route 97, Section A. Contract awarded to Fredericksen & Westbrook, Sacramento, \$10,376.

BUTTE COUNTY—At Campbell Creek Overbutte, about 5½ miles northwest of Oroville, a reinforced concrete bridge to be constructed and about 0.5 mile of approaches to be graded and surfaced with crusher run base and seal coat. District III, Route 87, Section B. F. Kaus & W. Youmie, Stockton, \$16,594; Engineer's Ltd., Sacramento, \$19,800; M. A. Jenkins, Sacramento, \$16,682. Contract awarded to Frank J. Reilly, San Francisco, \$16,116.

BUTTE COUNTY—At Butte Creek about four miles southeast of Chico, about 0.3 mile in length, constructing a graded roadbed and constructing plant-mixed surfacing on crusher run base. District III, Route 87, Section B. Hemstreet & Bell, Marysville, \$13,146; Claude C. Wood, Lodi, \$12,597; Johnston Rock Co., Inc., Stockton, \$17,178. Contract awarded to Wayne Youmie, Chico, \$12,042.

FRESNO COUNTY—Three bridges across Jacalitos Creek and overflows, about four miles southeast of Coalinga, to be constructed. District VI, Route 138, Section A. Trewhitt-Shields-Fisher, Fresno, \$18,281; Jourdan Concrete Pipe Co., Fresno, \$20,997; L. D. Tonn, Lodi, \$21,995; Albert H. Siemer & John Carcano, San Anselmo, \$22,806. Contract awarded to F. Kaus, Stockton, \$18,243.

GLENN COUNTY—At Butte City, existing bridge across Sacramento River to be removed. District III, Route 45, Section B. Wixson & Crowe, Shasta Dam, \$24,500; Kiss Crane Service, Berkeley, \$15,939; J. S. Metzger & Son, Los Angeles, \$20,000; Frank J. Reilly, San Francisco, \$13,951; M. A. Jenkins, Sacramento, \$10,838. Contract awarded to Lee J. Immel, Berkeley, \$7,750.

KERN COUNTY—Between Famoso-Woody Road and Deepwell Ranch, about 5.6 miles to be graded and road-mix surface treatment applied. District VI, Route 129, Section B. Fredericksen & Westbrook, Sacramento, \$89,477; Basich Brothers, Torrance, \$90,239; Macco Construction Co., Clearwater, \$90,645; J. E. Haddock, Ltd., Pasadena, \$94,673; Rexroth & Rexroth, Bakersfield, \$95,473; A. Teichert & Son, Inc., Sacramento, \$96,462; Louis Biasotti & Son, Stockton, \$98,630; Gibbons & Reed Co., Burbank, \$104,620; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$107,168; A. S. Vinnell Co., Alhambra, \$116,502; Lang Transportation Corp., Los Angeles, \$116,913; Brown Materials Co., Ltd., Avenal, \$118,296; Johnston Rock Co., Inc., Stockton, \$122,972; Rhoades Bros., Los Angeles, \$133,595. Contract awarded to Griffith Co., Los Angeles, \$89,432.

LOS ANGELES AND ORANGE COUNTIES—Six miles east of Long Beach, a reinforced concrete bridge across San Gabriel River to be constructed and about 0.2 mile of roadway to be graded and surfaced with plant-mixed surfacing. District VII, Route 179, Sections A.A. Byerts & Dunn, Los Angeles, \$47,409; Martin & Schmidt, Contractors, Long Beach, \$47,505; Carlo Bongiovanni, Los Angeles, \$48,343; Oscar Oberg, Los Angeles, \$52,360; J. S. Metzger & Son, Los Angeles, \$53,942; Oberg Bros., Los Angeles, \$55,693; J. R. Bishop, Long Beach, \$55,883; Dimmitt & Taylor, Los Angeles, \$56,125; Griffith Co., Los Angeles, \$60,817. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$42,403.

MONTEREY COUNTY—Between Peachtree Valley and Mustang Ridge, about 4.6

miles to be graded, surfaced with imported borrow and road-mixed surface treatment to be applied. District V, Route 10, Section B.C. Fredericksen and Westbrook, Sacramento, \$197,117; Louis Biasotti & Son, Stockton, \$197,939; N. M. Ball Sons, Berkeley, \$198,851; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$201,487; Macco Construction Co., Clearwater, \$223,760; Clarence Crow, Los Angeles, \$229,073; A. Teichert & Son, Inc., Sacramento, \$242,341. Contract awarded to Harms Bros., Sacramento, \$187,013.

RIVERSIDE COUNTY—Between Elsinore and Corona, from 8 to 10 miles northwest of Elsinore, about 1.7 miles to be graded and road-mix surface treatment to be applied. District VIII, Route 77, Sections C. D. A. S. Vinnell Co., Alhambra, \$58,809; J. E. Haddock, Ltd., Pasadena, \$61,313; Rexroth & Rexroth, Bakersfield, \$64,722; Matich Bros., Elsinore, \$64,736; Griffith Co., Los Angeles, \$67,478; Dimmitt & Taylor, Los Angeles, \$68,220; Daley Corp., San Diego, \$73,928; Chas. H. Johnston, Los Angeles, \$75,653. Contract awarded to Oswald Bros., Los Angeles, \$57,140.

SAN BERNARDINO COUNTY—At Malaga Underpass near Fontana, widening with portland cement concrete and plant-mixed surfacing. District VIII, Route 9, Section A. George Herz & Co., San Bernardino, \$7,047; Matich Bros., Elsinore, \$6,631. Contract awarded to Vido Kovacevich, South Gate, \$4,987.

Guard Rail Installed

(Continued from page 12)

A 20 foot oil mix surfacing using local materials has now been completed throughout this entire section which provides a very rideable surface. Because of the precipitous nature of the terrain, construction necessarily involved a great deal of curvature some of which is quite sharp with limited sight distance, but the grades generally throughout this section are very reasonable.

This section of the Roosevelt Highway (sometimes known as the Carmel-San Simeon Highway) lies entirely along the ocean at the foot of the Santa Lucia Range of mountains. It is one of the most scenic highways in California, and that it is nationally so recognized is evidenced by the large number of cars from eastern states which annually pass over it.

The Union Paving Company, contractor on this work, has made very satisfactory progress and it appears at this writing as though the project will be completed within the 100 working days allotted. Mr. Paul I. Wagner was Inspection Engineer for the Division of Highways.

Highway from Palms to Pines

(Continued from page 26)

areas. Reconnaissance surveys were made on several alternates by the county of Riverside, the present routing being chosen from a cost and use standpoint.

Construction was started in 1929 by the county of Riverside using prison labor and by 1931 approximately twenty-three miles of graded roadway was completed. From 1931 to 1932 the U. S. Forest Service, under a contract, constructed a ten mile section and during the same period the Riverside County Road Department built the easterly four-mile portion. Surfacing was placed in 1933 by cooperative effort of the U. S. Forest Service and the Riverside County Road Department, under attention of the U. S. Bureau of Public Roads.

The road was built in general to a twenty-two to twenty-four foot road-bed width, and about seventeen and one-half miles of rock subgrade stabilizer was placed before the surfacing was applied.

This route was adopted by the State as a State highway in 1933. Since coming into the State Highway System, the entire length of surfacing, which is of the oil-mix type, has been covered with seal coat, and about seventy-five hundred feet of guard rail has been placed along the most winding of the grades.

San Jose Underpass

(Continued from page 21)

concrete of almost one-half block either side of Polhemus Street as well as about one-half block back on Polhemus. New curbs, gutters and sidewalks were also constructed on Stockton Avenue where the existing facilities of a like type had to be removed due to line or grade changes.

The new subway was opened to the public at 11.30 a.m. on Saturday, October 19, 1940, after ribbon-cutting ceremonies which were unique inasmuch as not a single speech was made, or, as a San Jose newspaper put it: "The new subway 'left them speechless.'"

State of California

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Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

FRANK W. CLARK, Director of Public Works

FRANZ R. SACHSE, Assistant Director

MORGAN KEATON, Deputy Director

CALIFORNIA HIGHWAY COMMISSION

LAWRENCE BARRETT, Chairman, San Francisco
LEONER W. NIELSEN, Fresno
AMERIGO BOZZANI, Los Angeles
BERT L. VAUGHN, Jacumba
L. G. MITCHCOCK, Santa Rosa
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G. T. MCCOY, Assistant State Highway Engineer
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T. H. DENNIS, Maintenance Engineer
F. W. PANHORST, Bridge Engineer
L. V. CAMPBELL, Engineer of City and Cooperative projects
R. H. STALNAKER, Equipment Engineer
J. W. VICKREY, Safety Engineer
E. R. HIGGINS, Comptroller

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L. H. GIBSON, District V, San Luis Obispo
E. T. SCOTT, District VI, Fresno
S. V. CORTELYOU, District VII, Los Angeles
E. Q. SULLIVAN, District VIII, San Bernardino
S. W. LOWDEN (Acting), District IX, Bishop
R. E. PIERCE, District X, Stockton
E. E. WALLACE, District XI, San Diego

SAN FRANCISCO-OAKLAND BAY BRIDGE

RALPH A. TUDOR, Principal Bridge Engineer, Maintenance and Operation

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GEORGE W. HAWLEY, Deputy in Charge Dams
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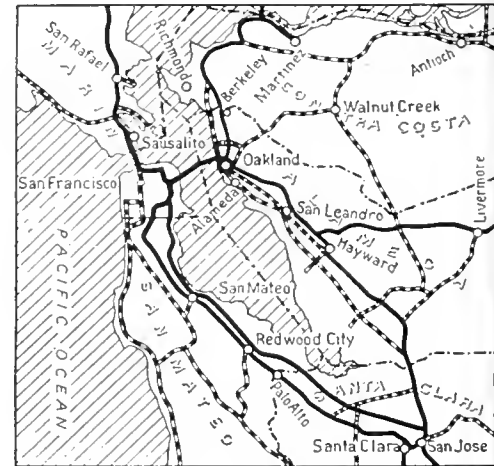
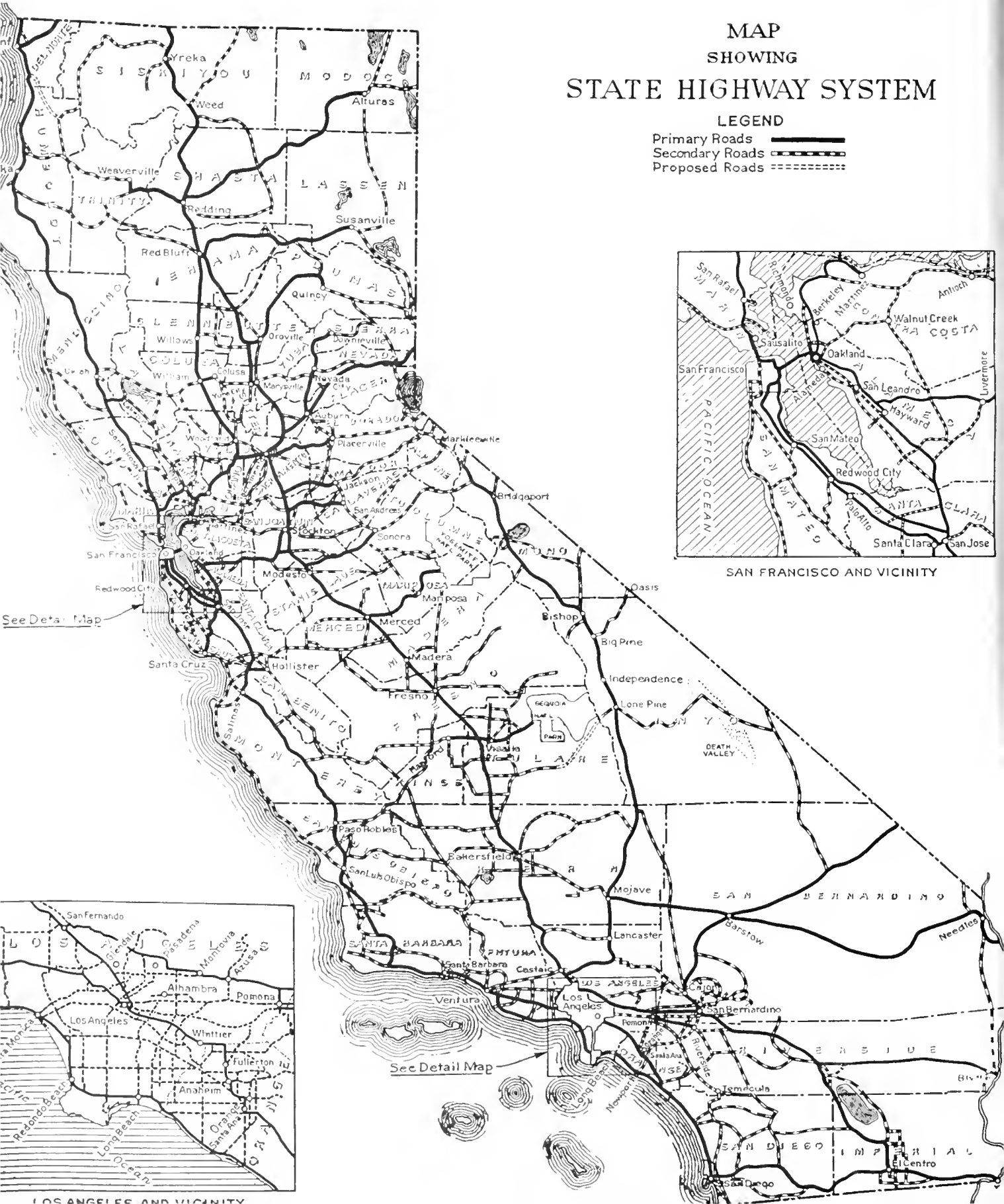
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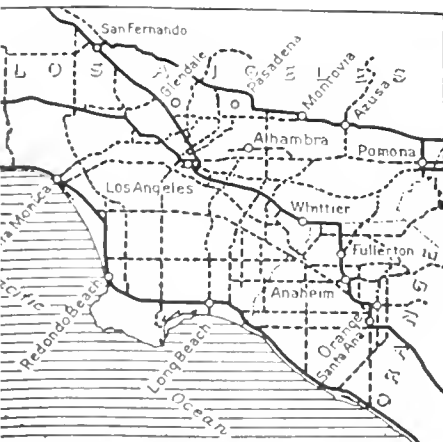
MAP SHOWING STATE HIGHWAY SYSTEM

LEGEND

- Primary Roads
- Secondary Roads
- Proposed Roads



SAN FRANCISCO AND VICINITY

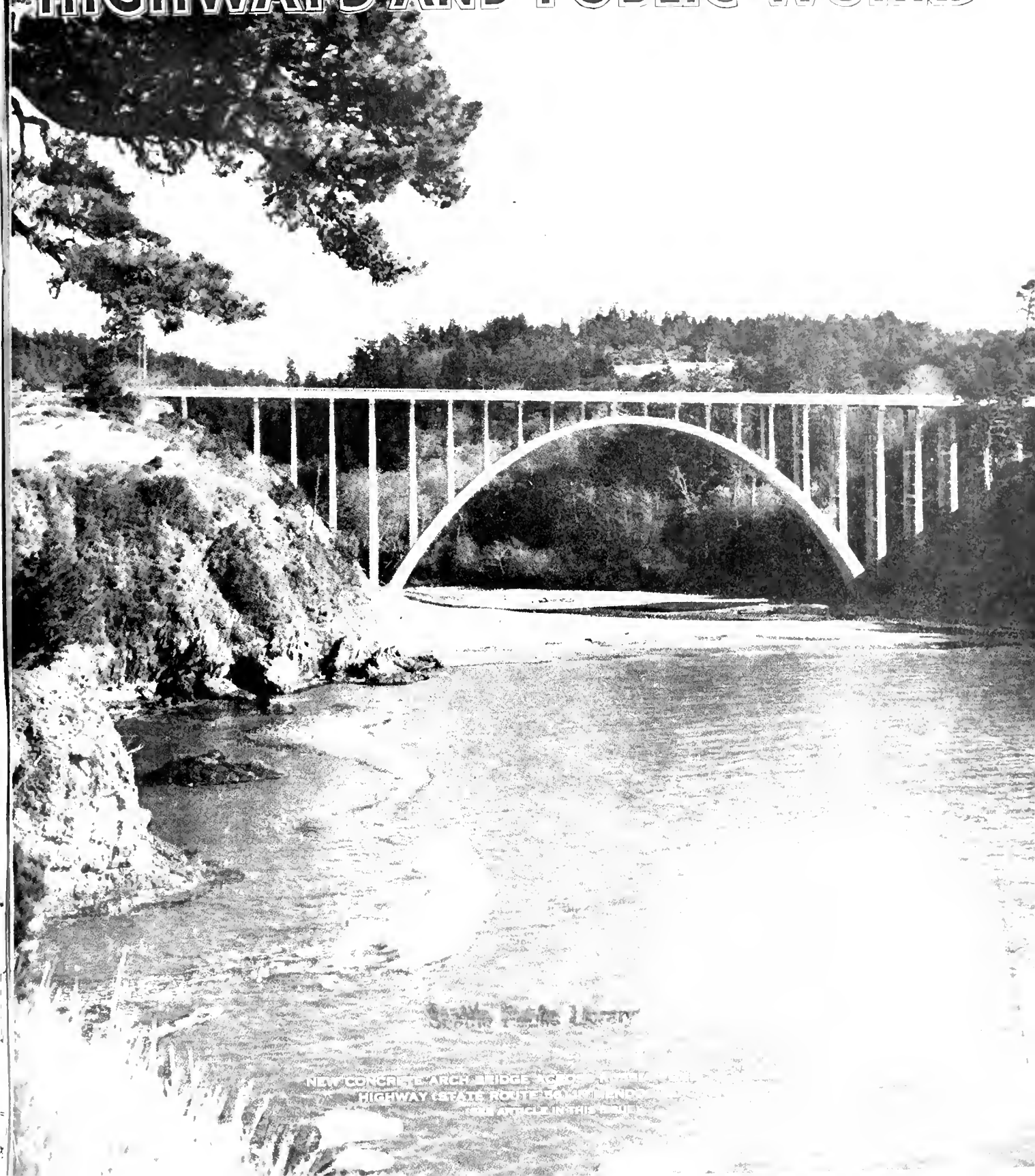


See Detail Map

LOS ANGELES AND VICINITY

CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



NEW CONCRETE ARCH BRIDGE ACROSS THE RIVER
HIGHWAY (STATE ROUTE 99) AND
THE ARTICLE IN THIS ISSUE

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

Official Journal of the Division of Highways, Department of Public Works, State of California

FRANK W. CLARK, Director

C. H. PURCELL, State Highway Engineer

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700 Bridges on Federal Military Highway Network in State Inadequate for Defense Needs

By F. W. PANHORST, Bridge Engineer

A PRELIMINARY study shows that nearly half the bridges on the Military highway net work in California will have to be replaced, widened or strengthened in order to bring them up to the standards required by the War Department.

In the November issue of "California Highways and Public Works," Mr. C. H. Purcell, State Highway Engineer, discussed the importance of a proper system of highways as part of a national defense program and pointed out the woeful inadequacy of available funds for bringing the existing highway system up to needed standards. It was shown that not only must existing roads be widened and reconstructed to carry a large volume of traffic with heavy load concentrations but also new arteries of travel must be provided.

In this connection the present condition of highway bridges merits particular attention because of its relative importance in the general problem of reconstructing the highways. That it is important is shown by statements made by the United States Public Roads Administration and others to the effect that reconstruction of bridges should be given first consideration in undertaking the highway reconstruction program.

EXPENSE RESTRICTION

A bridge can be looked upon as a very expensive section of highway. Because of their cost, it is general practice to restrict the roadway somewhat at bridges, and in many cases—also because of the expense—bridges are not widened when the road is reconstructed to proper standards. The general result has been a lag in



An old timber truss bridge that collapsed under a truck and trailer loaded with a power shovel, both vehicles being considerably over the posted weight limit. The truck and fallen span lie in shallow water

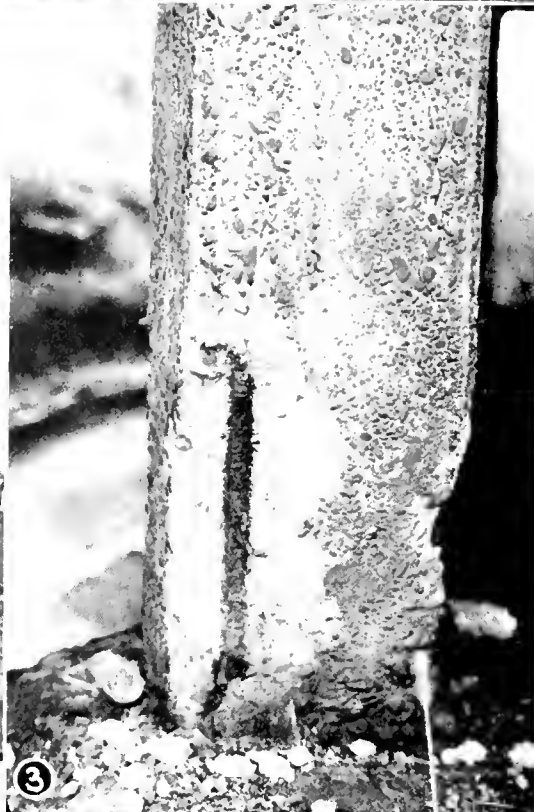
bridge construction with regard to providing proper roadway widths and standards of alignment at the bridge and its approaches. In these respects restrictions on travel are the same as in the case of the roadway except that the remedy in the case of bridges is harder to apply because of the greater relative cost.

However, the maintenance of old weak structures is a condition which, if not remedied, has more sinister possibilities than the maintenance of narrow roadways or inadequate roadbeds. Usually, it is possible to get traffic over a road somehow, no matter how bad its condition, perhaps at the cost of some delay and extra maintenance. The failure of a bridge, or a major part of it, means that traffic stops and may wait hours or days for either a detour to be built or repairs to be made.

ARMY HELD UP

In some cases other routes are possible at the cost of extra travel and extra road maintenance, but often—and this is particularly true of California with its large areas of rugged topography—there are no practicable detour roads. Only a few years ago highway traffic, including a unit of the United States Army, sat down and waited several days for a new bridge to be built over a deep ravine on the Redwood Highway to replace one that had failed completely and could not be repaired.

It makes no difference as far as the effect on traffic is concerned whether a bridge fails because of weakness or is blown up by a retreating enemy. Even a superficial study of the developments of the war in Europe will



No. 1—Light, narrow bridge posted and likely to collapse if struck by a vehicle out of control. No. 2—Inadequate expansion detail in concrete girder span caused serious cracking. No. 3—Poor concrete in pile coupled with abrasion by floating drift resulted in serious weakening. No. 4—Support piles weakened by marine borers

show the importance of keeping a bridge in place, or demolishing it if you are on the retreating side.

Not only in war but also in times of peace are weak bridges a matter of serious concern. Always a hazard, the danger is increasing constantly because of the wear and tear of growing numbers of heavy commercial vehicles and the tendency toward greater load concentration.

Because of the unscientific provisions of the present motor vehicle laws, maximum loadings may be carried by each type of vehicle no matter how closely its axles are bunched together, and the use of shorter vehicles is increasing because of the need for maneuverability and the public's objection to passing long vehicle combinations.

REDUCED SAFETY FACTOR

Because of the weight concentrations, the public now finds that a large portion of the safety factor built into its modern bridges is encroached upon. The increased stresses in bridge members over those contemplated in their design may not be a matter of immediate concern but will be, and in fact is already being, reflected in increased cost of maintenance and shorter service life. The serious problem, however, is the effect on a large number of existing bridges designed to a lower standard or so deteriorated that little or no safety factor remains under the maximum loads possible under the present law.

32S NOW POSTED

In connection with the use of roads for war purposes the War Department has accepted the H-15 design standard for bridges that are to carry military loads such as are now contemplated. The so-called "H" loadings are in general used throughout the United States for the design of highway bridges.

The H-15 loading which is based on a fifteen ton truck with 24,000 pounds on its rear axle, is the particular loading used for a large majority of the nation's highways. For long spans this loading assumes the 15 ton truck to be followed and preceded by similar 12½ ton trucks spaced at 30 foot intervals. It is of particular interest to consider the situation with regard to bridges that are not up to this standard.

First, let us take the State Highway System as a whole.

At the present time there are 235 bridges on the State Highway System legally posted for less than the load limit provisions of the Vehicle Code. These reductions in the loading are based on factors of safety that are considerably less than those incorporated in the design of a new bridge, and this is permitted only because such bridges are under regular and frequent inspection by competent men. Likewise, in such cases saving in maintenance costs or prolonging the service life of the bridge is waived to a large extent.

While it is true that these posted bridges are being repaired or replaced continuously, others are steadily deteriorating or being damaged to the point where they also must be posted, and many large and strategically located structures are included in this classification. In addition to the above number there are 94 bridges posted for reduced speed either because they are not strong enough to withstand the pounding of heavy high-speed traffic, or because impact from a mis-handled vehicle might bring about complete collapse of a span.

It is estimated that about 230 more bridges may have to be posted for reduced loadings within the next two or three years. Another 320 bridges or so are not up to modern standards, but it is expected—or at least hoped—they can be kept in service for several more years without posting for reduced loads.

1200 BELOW STANDARD

Although not included in the class of weak bridges, there are about 430 other bridges inadequate in either width of roadway or alignment of the bridge and approach roadway. Thus there are about 1200 State bridges, out of a total of 4200, not up to an acceptable standard, and the general condition of 8000 or more bridges on county roads is known to be a still more serious problem.

At the beginning of the current biennium it was estimated that about \$9,000,000 would be required to replace the bridges unsafe for legal loads. Many bridges included in this total have been replaced, but others—as already stated—have reached the same stage. It was estimated also that it would take \$35,000,000 to replace all the structurally inadequate bridges, that is, all

(Continued on page 18)



Pictures 1 and 2 show decay in bents of this timber overhead structure evidenced by settlement of the deck. No. 3—A defect in expansion detail of concrete girder structure resulted in disintegration of beam. Note temporary timber supports on shallow footings. No. 4—One-way timber suspension span posted and reinforced by adding additional hangers between originals

Governor Olson Discusses Highway Development in Next Ten Years

By CULBERT L. OLSON, Governor of California

ADEQUATE development of the California State highway system during the coming decade is dependent upon a variety of diversified and, at the same time, interwoven factors. While it is quite impossible in any short statement to cover in detail all such factors confronting State officials charged with the responsibility of highway administration, there are three or four outstanding problems whose satisfactory solution is fundamental to adequate highway development.

During the past ten years, motor vehicle registration in California has increased by nearly three-quarters of a million cars and trucks. It would be a conservative estimate that, during the coming ten years, the increase will be about the same. This means that, where this State now has approximately 2,700,000 registered motor vehicles, by 1950 the number will be around 3,300,000.

California has a State highway system of 13,865 miles. The volume of traffic using this system today is such that on certain sections in the more densely populated districts in large urban areas traffic congestion presents a serious problem. Looking ahead toward 1950, it is most apparent that, with a prospective increase in traffic volume of between 20 and 25 per cent, the problem of congestion on State highways may be far more serious than at the present.

It is, therefore, necessary that during the next ten years the State must make a most determined effort to provide highway facilities capable of moving traffic freely and safely.

Some such facilities have recently been completed, others are under construction and still others are in the preliminary stages of design.

Results of engineering studies and research have evolved that construction of comprehensive systems of freeway routes leading from urban centers to the rapidly develop-



GOVERNOR CULBERT L. OLSON

ing suburban areas present the best solution to congestion around cities. In California, one such freeway, the Arroyo Seco Parkway, has recently been opened to traffic between Pasadena and down town Los Angeles. Another, the Cahuenga Freeway leading from Hollywood toward the San Fernando Valley is partially completed and work is rapidly progressing on Olympic Boulevard leading westerly from Los Angeles towards Santa Monica.

In the San Francisco Bay area detail plans are now in preparation for converting the Bay Shore Highway between Palo Alto and San Francisco into a freeway and preliminary designs are being prepared for other such arterials along the east shore of the bay.

Other phases of highway development which must be continued in rural sections include construction of greater mileages of divided high-

ways for high speed, interurban travel on main arterials. In both urban and suburban areas the building of separate routes restricted to the use of truck transportation is still another method which has proven of great assistance to the free movement of traffic and the number of such routes must be increased.

One of the greatest problems confronting the State in providing highway facilities which are sufficient for an increasing traffic volume is that of the obsolescence of bridges. On the California State highway system there are some 3500 bridge and grade separations. Approximately 25% of these structures are inadequate for present day traffic. Many built in past years are too narrow or restricted as to clearance for modern automotive equipment. Others are inadequate in design and structurally insufficient for loads and speeds which now obtain. In addition to those structures which should now be replaced, others will prove to be inadequate during the next ten years. Besides these bridges, there are still others which are structurally sound but which should be replaced because of their location on inferior alignment.

The magnitude of the bridge problem is such that it is estimated by the State Highway Engineer that an amount of approximately \$75,000,000 will be necessary to provide the California State highway system with adequate bridge structures.

During the past few months another factor of no mean proportions has presented itself to complicate the situation. There is no doubt that one of the most important problems confronting the American people today is that of national defense. One of the prime necessities of a defense program is a complete system of strategic highways over

(Continued on page 13)

White Bars on Pavement Give Danger Warning

ACCIDENT experience has shown that the raised bar on the pavement, painted white, is an effective device in traffic guidance and control at underpass approaches, the beginnings of divided highways, the protection of center placed traffic signs, such as KEEP TO RIGHT signs, at roadway intersections and wyes, and in divided highways to accentuate the neutral strip.

For some time past the Division of Highways has been experimenting with these traffic control devices. Bars of different materials constructed at various heights, slopes and angles have been installed. Careful observations of their effectiveness have been made. The reaction of the motorist has been noted. Conclusive evidence of their practicability has been obtained.

PROVIDE DOUBLE WARNING

Psychologists tell us that a major portion of our impressions come through our eyes and that a slightly lesser percentage of our actions are visually controlled. These whitened bars are so laid as to constitute a visual warning of an approaching hazard. Angled and raised in a manner to convey high visibility, their warning is transmitted a long distance to the motorist.

But if the sense of sight is lazy or inactive for the moment—and sight should be the most actively awake sense of the motor car driver—a second sense is jarred into hazard recognition by the raised bars. A car bumping over but a bar or two should arouse a dozing driver immediately, be it a mental or physical napping, and give him a sharp warning of danger.

Present experience seems to indicate that the bars should be laid on an angle of about forty-five degrees to the center line of traffic. To give good long distance visibility, they should be not less than six inches wide with the far face higher than the near face. However, some bars have been constructed with a flat top surface—and have been effective.

(Continued on page 6)



Control and guidance of traffic by raised white bars proves effective for intersections, wyes, neutral strips on divided highways and protection of central placed signs



Constructing sidehill viaduct carrying State highway across slide area along Russian River

Russian River Sidehill Viaducts

TWO sidehill viaducts are now under construction on the Russian River near Guerneville on State Sign Route 12 in Sonoma County. One of the structures has a length of one hundred and twelve feet and the other, two hundred and fifty-two feet. They will carry sections of roadway on the steep banks of the Russian River approximately fifty feet above the river.

The design of each of the structures is similar in that the decks or roadways consist of reinforced concrete continuous slab spans twenty feet in length built on open steel pile bents.

Each viaduct will provide a 26 foot clear roadway width and a single four foot pedestrian sidewalk with standard concrete handrail on the river side of the viaducts.

Due to the instability of the roadways at the sites of the viaducts, it has been necessary to construct the deck slabs the full width of the road-

way in approximately half of the length of each of the structures.

Steep slopes and unstable soils often make it impractical to maintain a graded highway. Or perhaps expensive property improvements adjacent to the proposed road prevent the spreading out of cuts and fills to obtain a stable roadbed.

In such cases it may be economical to resort to structures supporting the roadway whose supports can be made to reach more stable foundation. Although such structures are also expensive, they pay for themselves through future savings in maintenance.

Although the ideal foundation for bridges is rock—solid, native rock—it is frequently necessary to make use of some less favorable material. In that case the bridge design is modified to take full advantage of conditions. A case in point are the sidehill viaducts pictured here which are being constructed to carry the new State highway across dangerous slide

areas along the Russian River near Guerneville. Here steel piles were driven through several feet of soft material to a firm foundation and encased in concrete for protection. The open steel bents will permit the free flow of over-saturated muck beneath the structures while the concrete spans carry the motorists over in safety.

White Bars on Pavement Give Danger Warning

(Continued from page 5)

It must be borne in mind that feasibility of construction and ease of maintenance must be a prerequisite in the placement of raised bars. By their very use, it is expected that they will be damaged and must needs be repaired for they are in a way a gentle but emphatic warning of danger rather than a barrier such as a solid high concrete curb or a fixed guard rail.



Two sidehill viaducts being constructed along the Russian River near Guerneville in Sonoma County provide 26-foot roadways of reinforced concrete. Continuous slab spans 20 feet in length are built on open steel pile bents. Four-foot pedestrian sidewalks with concrete rails are provided on the river side

Four-Lane Divided Highway Being Constructed East of Redlands

By A. EVERETT SMITH, Assistant Resident Engineer

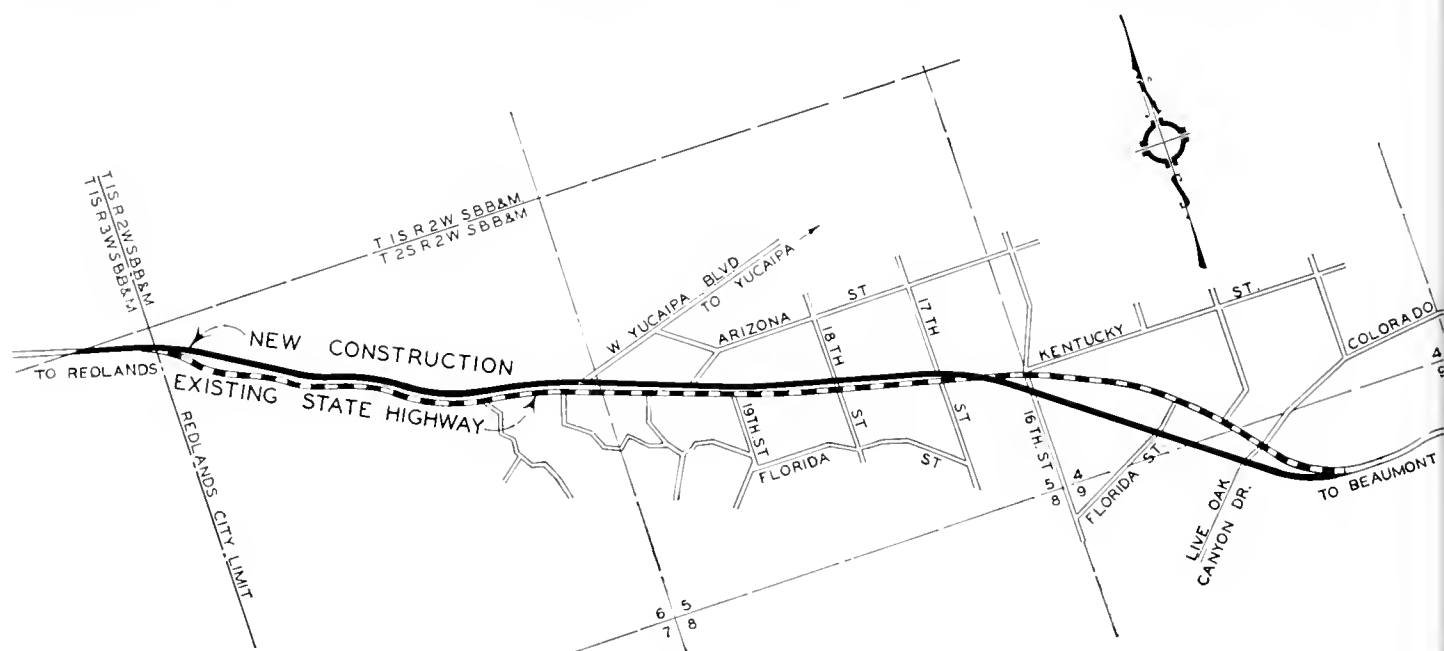
AS AN additional step in improving U. S. Highway 99, a State highway contract was recently awarded and work commenced by Dimmitt and Taylor, contractors. This project begins near the east city limit of Redlands and extends easterly through the Crystal Springs canyon and over adjacent rolling terrain toward Beaumont for a total distance of 3.11 miles.

situated in limits of the new dividing strip.

From near 17th Street the grade will be constructed to a four-lane divided highway section on new improved alignment south of the existing road, with a transition at Florida Street decreasing the roadbed width to a two-lane section at a point of adequate sight distance. The two-lane section will continue to and

permit the faster vehicles to pass heavy laden trucks and other slow moving vehicles without danger of head-on collision.

Traffic over this route is heavy, with a marked increase during winter months due to the popularity of desert resorts. A large volume of heavy truck traffic is also carried by this route, hauling produce supplies and freight between the Imperial Val-



The project consists in general of constructing a graded roadbed and placing an approved surfacing aggregate and installing drainage structures. A two-lane graded roadbed will be constructed north of the existing pavement from the east city limit of Redlands to 17th Street, as shown by the accompanying reference map.

The existing pavement will be left intact to carry eastbound traffic and the new lanes will relieve the now overtaxed road of westbound traffic. Many large eucalyptus trees bordering the north side of the existing pavement will remain in place, being

merge into the existing two-lane pavement ahead.

By utilizing the existing pavement west of 17th Street, two and one-half miles of four-lane highway with a central dividing strip will be available east of Redlands city limit.

This project makes connection to the west with an improvement completed in 1938 in which 2.4 miles of Portland cement concrete pavement was placed on new alignment eliminating numerous sharp horizontal and vertical curves which affected sight distance in that section.

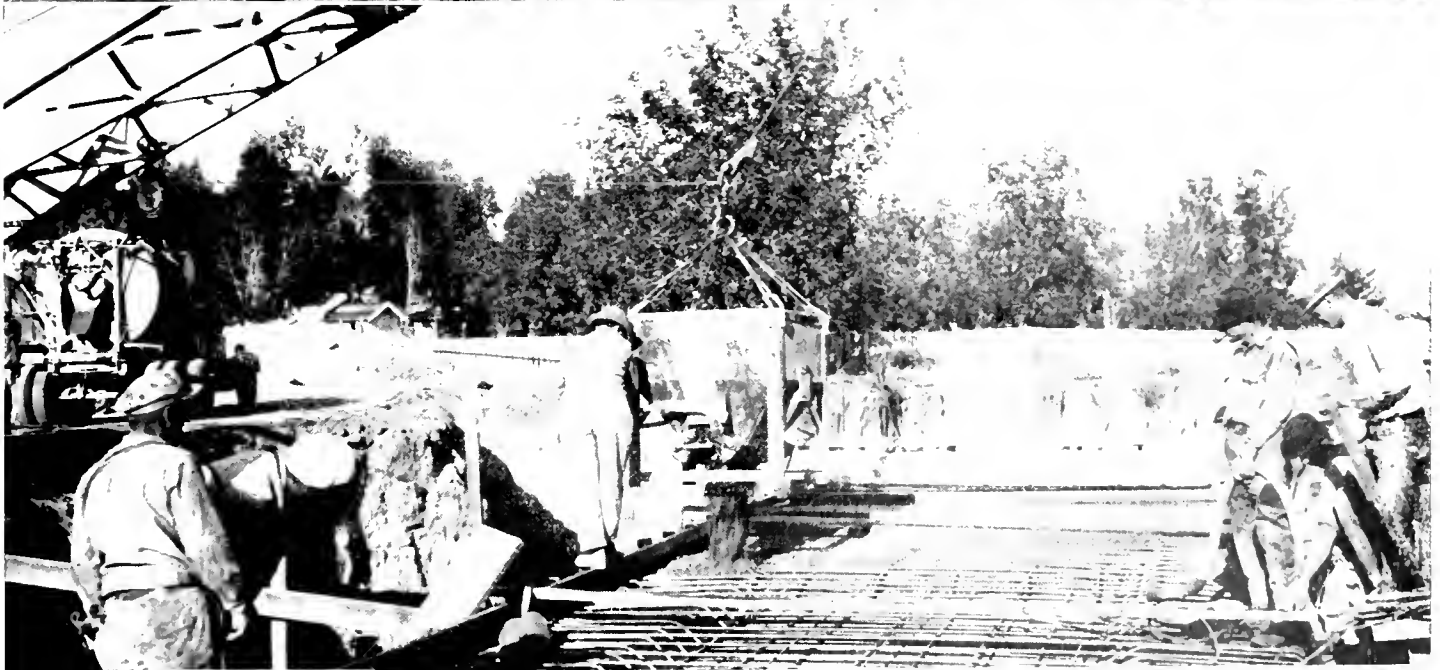
The four-lane divided section through Crystal Springs canyon will

ley and the Los Angeles markets and harbor area.

Preliminary to construction, much work was required in clearing the new right of way of buildings and moving public utility facilities out of the way.

Construction work which is still in the early stage includes clearing and grubbing, roadway excavation, placing reinforced concrete pipe culverts and the construction of a 12 by 12 foot reinforced concrete box culvert in Yucapa Creek.

This work is under the supervision of O. B. Brinkerhoff, Resident Engineer.



Top picture shows grading for section of 4-lane divided highway project near Redlands leaving trees in dividing strip with existing road for other 2 lanes. Other views show placing of concrete pipe and construction of box culvert



Four-lane approach highway on new alignment to connect with north end of San Rafael Viaduct

Highway Viaduct In San Rafael

TO CARRY a large volume of traffic at high speed through cities and thickly populated areas expensive structures must often be built. By their use, delays due to cross traffic are avoided and the service to adjacent properties separated from the arterial traffic.

A four-lane divided highway viaduct is being constructed in the City of San Rafael over approximately five city blocks of residential and industrial property in order to carry the fast, heavy Redwood Highway arterial traffic through the city with a minimum of interference to the local properties and traffic.

The viaduct will be a reinforced concrete structure approximately twenty-two hundred feet in length and will provide a fifty foot divided roadway elevated about twenty-five feet above the adjoining ground. Five city street grade separations will thus be provided as well as grade separations for the ingress and egress of

each direction of traffic on the arterial highway.

Considerable engineering study was necessary in the planning of the San Rafael viaduct in order to secure a structure of good aesthetic qualities that will blend with the development of the city and yet be an economical structure of sound engineering design. The spans have been designed of variable lengths to fit the numerous conditions along the structure and provide the utmost in economy.

The viaduct which occupies the creek channel of Irwin Creek, a stream which carries the run-off from practically all the streets in the eastern portion of San Rafael, will have a total of 67 spans varying in length from 17 feet to 57 feet 6 inches.

The superstructure is of two types: The northerly nine spans and the southerly 22 spans are reinforced concrete slab construction and the interior spans of the reinforced concrete girder type. Slab spans pro-

vide minimum clearance for the traffic on cross streets. Transitions from the slab spans to the girder spans are designed continuous. Expansion joints will be placed from 120 feet to 150 feet apart.

To provide a new channel for Irwin Creek along the center line of the viaduct between the two center columns the bridge was designed with four-column vents or piers. Reinforced concrete box culverts are being constructed under Fifth Avenue, Fourth Street, Third Street and Second Street to carry the channel water. The whole structure is founded on piles.

A unique feature of the viaduct structure is that the girders are curved concentrically with the center line to provide a uniform view from underneath. The use of curved girders simplifies deck form work and also provides a uniform cantilever distance from the outside girder to the deck.

(Continued on page 20)



Upper picture shows 4-lane highway viaduct under construction through San Rafael at junction with existing highway to San Francisco. Lower shows deck forms and reinforcing steel details

Cities Designated to Take Over The Martinez-Benicia Ferry

By FRANK W. CLARK, Director of Public Works

BY his executive approval of enabling legislation passed by the legislature in special session, Governor Culbert L. Olson on December 5 made it possible for the Department of Public Works to request the American Toll Bridge company to transfer and convey to the cities of Benicia in Solano County and Martinez in Contra Costa County the operative properties and franchises now owned by the Martinez-Benicia Ferry and Transportation Company.

It was my privilege as the Director of the Department of Public Works to formally request Mr. Will F. Morrish, President of the Toll Bridge Company, to apply to the California Railroad Commission for permission to turn its ferry properties over to the two cities situated on opposite banks of the Carquinez Straits across which the ferry now operates.

As this issue of California Highways and Public Works goes to press, the necessary legal steps for public ownership and operation of the ferry system are being taken by the Toll Bridge Company and the interested municipalities.

MADE URGENCY MEASURE

At Governor Olson's request, the bill empowering the cities of Martinez and Benicia or either of them was made an urgency measure to take effect immediately and was passed by both houses of the legislature. The bill was authored by Senators Thomas McCormack, representing Solano County, and T. H. Delap, of Contra Costa County. A companion measure was sponsored in the Assembly by Assemblyman Ernest Crowley of Fairfield and Assemblyman Harold F. Sawallisch of Richmond.

Under the law as it existed prior to passage of the McCormack-Delap bill and its signing by the Governor, cities of the sixth class such as Martinez and Benicia had no

legal authority to acquire or operate a ferry system. Under the measure approved by the Governor this was made possible.

EMPOWERED TO DECIDE

When the State of California through the California Toll Bridge Authority acquired the Carquinez and Antioch bridges and other properties of the American Toll Bridge Company, it was agreed between the contracting parties that the Director of Public Works should decide what disposition should be made of the Martinez-Benicia ferry, which the Toll Bridge Company desired to abandon.

The Director was empowered to designate Solano and Contra Costa counties or either of them; or the cities of Martinez and Benicia or either of them; or a cooperative organization composed of the employees of the ferry who were desirous of operating the system in the event that the counties or the cities declined to take over the utility.

It was the belief of Governor Olson, the members of the California Toll Bridge Authority and myself, as Public Works Director, that the interest of the public and those persons using the ferry would best be served if either the counties or the cities affected assumed operation of the ferry.

CITY OPERATION FAVORED

At a joint meeting of the boards of supervisors of Solano and Contra Costa counties, the officials of the cities of Martinez and Benicia and representatives of the employees, it was the consensus that the cities should apply for the right to own and operate the transportation system.

The employees of the ferry have rendered faithful service over a period of years and it is the hope of Governor Olson and myself that every consideration relative to their

continued employment will be given to them by the new owners of the ferry system. The bill which made possible public ownership of the Martinez-Benicia ferry reads as follows:

PROVISIONS OF BILL

An act to add Sections 862c and 862d to an act entitled "An act to provide for the organization, incorporation, and government of municipal corporations," approved March 13, 1883, relating to the acquisition and operation of ferries by cities of the sixth class, either alone or jointly with other cities of the same class or counties, to take effect immediately.

The people of the State of California do enact as follows:

SECTION 1. Section 862c is hereby added to the act cited in the title hereof, to read as follows:

Sec. 862c. Any city of the sixth class, through its city council, may by gift, purchase or eminent domain acquire any existing ferry, together with any franchise, wharf or landing place necessary for its operation, and may operate such ferry upon navigable waters within or adjacent to the territorial limits of the city. The cost and expense of such acquisition and operation may be paid for out of the city's general fund. Any such ferry may, in the council's discretion, be operated either as a toll or free ferry.

SEC. 2. Section 862d is hereby added to said act, to read as follows:

Sec. 862d. Any city of the sixth class, through its city council, may, pursuant to contract, join with another city of the same class or with any county in acquiring any existing ferry, together with any franchise, wharf or landing place necessary for its operation, and in operating such ferry upon navigable waters lying within or adjacent to the territorial limits of both cities or of the city and the county. Each of the contracting parties may pay its proportionate share of the cost and expense of acquiring and operating the ferry out of its general fund. Any such ferry may, in the discretion of the legislative bodies of the contracting parties, be operated either as a toll or free ferry.

SEC. 3. This act is hereby declared to be an urgency measure for the immediate preservation of the public peace, health and safety within the meaning of Section 1 of Article IV of the State Constitution and shall therefore go into immediate



Martinez-Benicia Ferry authorized by Legislature to be transferred to cities as designated by Director of Public Works Clark

effect. A statement constituting such necessity is as follows:

Under the terms of the agreement leading to the purchase by the State of the Carquinez Bridge, the seller is obligated to transfer its rights in a ferry operated by it between Benicia and Martinez to any city or county between or within which the ferry operates. This act is designed to implement and facilitate such designation by authorizing the cities and counties affected to acquire and operate ferries for operation over waters within or adjacent to their territorial limits. Until the authority is granted it is possible that the present owner of the ferry may abandon its operation thereof and relinquish existing franchises therefor. Should this happen, it would be impossible for many years to operate a new ferry in the same vicinity, in view of Section 12 of the California Toll Bridge Authority Act, to the detriment of the public interest and welfare. It is therefore a matter of extreme urgency that this act take effect immediately.

There are approximately 85,700 school buses in use in the United States, reports the Automobile Club of Southern California. Twice every school day these buses cover 1,250,000 miles of highway.

She: "What do you do?"

He: "I'm a panhandler."

She: "I'd be ashamed to admit it."

He: "Don't get me wrong. I work in a beauty shop, giving facials."

Governor Olson Discusses Highway Development in Next Ten Years

(Continued from page 4)

which movements of troops, munitions and supplies may be quickly and freely moved.

The effect upon highway construction in California by the necessary readjustment in the financing of projects to meet the demands of the proposed system of defense roads will be far reaching. The results of surveys made in this State for proposed improvements which would be required for the Federal strategic military road system indicate that approximately \$150,000,000 will be required for such work in California. In addition to this amount, a sum of some \$11,000,000 will be necessary for construction of access roads to several cantonments, naval and military reservations planned for this State.

The construction of such cantonments and military bases further complicates highway development

in their vicinity by reason of abnormal increases in population and buildings.

Most important of all factors relating to future highway construction and of vital import to all other factors is that of sufficient financing.

The program of State highway development indicated by the preceding paragraphs will require an income for highway purposes of much larger proportions than is available at the present. In the face of the apparent inadequacy of present revenues, reduction in Congressional appropriations for Federal Aid to the States presents a serious problem. The demand for development of a comprehensive system of strategic highways for national defense purposes complicates the financial problem to the extent that it would appear that there

(Continued on page 28)



At Arroyo Drive Bridge fern palms and floral plantings decorate slopes with ice plant on center strip

Landscaping Arroyo Freeway

NATURAL scenic beauties of Arroyo Seco through which runs the new Freeway between Los Angeles and Pasadena are being enhanced by landscape engineers of the Division of Highways.

Approximately ten thousand young plants of various varieties have been propagated especially for this landscaping project. Some 47 kinds of plants will be used in improving the right of way on either side of the new highway. Of these 42 are native species.

Eleven species of ceanothus, or wild lilac, are included in this list. The ceanothus produces brilliant clusters of flowers in light blue, bright blue, deep blue and white, providing a succession of flowers from mid-winter until June.

NAMED AFTER FREMONT

Named after its discoverer, General John C. Fremont, the beautiful Fremontia with its golden yellow blossoms will also be used in profusion,

as will the attractive Catalina cherry, with its heavy green foliage and the holly-leaved cherry, which is somewhat similar. These two shrubs are particularly adaptable where the planting area on each side of the boulevard is limited. They bear a rich green foliage throughout the year.

During the early summer months, the Freeway will be colorful with matilija poppies, together with yellow tree poppies. Clumps of California holly, or toyon, will be planted throughout the entire course of the boulevard and during the fall of the year and up until Christmas will provide a brilliant display of red berries.

NATIVE SYCAMORE GROUPS

Native to the Arroyo is the sycamore and many of these trees will be planted in clumps to tie in with the natural growth. The Nevins' barberry, with its large clusters of yellow flowers which bloom in the late winter months, will be used extensively.

Wild roses will be interspersed with the other plants throughout the length of the Freeway. On steep banks the wild buckwheat will be used profusely.

Other native plants to be used in the Arroyo Seco landscaping scheme will include purple sage, blue sage, bush snapdragon, manzanita, mountain mahogany, pink and yellow flowering currants, fuchsia, fuchsia flowered gooseberry, lemonade berry, laurel sumach, elderberry, bluebeard tongue and California fuchsia.

Among five exotic plants which will be used is an evergreen perennial morning-glory which is especially usable on steep banks. While this plant grows wild in many parts of southern California, it is not in general garden use. It will serve to cover unsightly inclines on Arroyo Seco and will add materially to the general color scheme.

When the landscaping is completed, the Division of Highways expects it will be an outstanding example of modern highway beautification.



Top and bottom pictures show plantings on slopes of Arroyo Seco Freeway including blue dawn flower, catsclaw, wild grape, trailing lantana, and honeysuckle, with Boston ivy on structure abutments and piers and oleanders and toyons in groups on slope tops. On dividing strips are compact myrtle and ice plant with cocos palms placed at center piers and close to structures. Center picture shows stages of slope planting and application of top soil

Evolution of Grading and Paving Methods in Highway Construction

By EARL WITHYCOMBE, Assistant Construction Engineer

IN NO form of construction has more rapid progress been made than in the field of grading. The development from the station-man's wheelbarrow and the horse-drawn scraper of thirty years ago to the present day tractor-drawn wheel scraper of thirty-cubic-yard capacity, marks considerable progress in dirt-moving methods.

The intermediate stage of power shovel and truck is now relegated to excavation in rock formation and to hauls that are beyond economical limits with scraper equipment. The rock has to be extremely hard or the hauls exceptionally long for the present day contractor to abandon scraper equipment for power shovels.

EQUIPMENT DEVELOPMENT

This evolution of equipment has not only resulted in a marked decrease in the unit cost of grading operations, but it has also made it possible to complete within a few months a project which formerly might have required a year or more. The dollar spent in construction these days yields a much larger return to the purchaser than it did thirty years ago.

Clearing and grubbing of the native growth, formerly performed by laborious hand methods supplemented by powder, is now largely done by tractor equipment.

These developments and adaptation of the modern power equipment to construction are the result of the painstaking experimentation of men in the construction industry. Many of the highly successful implements of the present day were looked upon as harebrained dreams by able operators of earlier times.

Embankments on railroad and highway construction were formerly built by end-dump methods and subsequent settlement took place over a period of many years. Maintaining the roadbed to the predetermined grade during this period of readjust-

ment was a costly and unsatisfactory practice.

Experimental projects were set up to construct embankments in thin layers which were wetted and rolled. These projects indicated that subsidence within the embankment itself could be avoided. Research developed methods of measuring the degree of compaction within the layers and definite limits were established. This advancement preceded the perfection of the tractor-drawn scraper. It fitted in admirably with this method of dirt moving and was a decided impetus to its development.

Engineers soon became aware of occasional subsidence due to inequalities in the original ground. It is now the practice to carry on a thorough investigation of the subsurface conditions which might affect the stability of the superimposed embankment. Particular attention is paid to the character of the soil, the presence of underground water, and any apparent weakness in the geological structure. This investigational work is done largely with drill rigs, and ranges in cost from \$75 to \$1,000 per mile. The necessary corrective measures are then decided upon from the results of the investigational work.

P. C. C. PAVEMENT METHODS

The methods employed in pavement construction have undergone many changes over the same period. The mixing machine was formerly the only piece of mechanical equipment employed on portland cement concrete paving construction. The batching and the laying of the mixture was performed entirely by hand. Charging the mixer with aggregates measured in wheelbarrows from stockpiles along the grade has now been supplanted by mechanical batchers. These are usually located at the point of origin of the aggregates, where the individual components are proportioned over automatic scales by dropping each batch into its proper com-

partment in a truck for delivery directly to the mixer.

The rough spreading of the mixture as it is dumped from the mixer is largely done by hand; but equipment is available and is coming into general use to spread the concrete faster and more efficiently by worming the mixture across the full width to be poured.

The laborious manner of hand compacting the concrete has been supplanted by mechanical compacting and screeding devices that produce a dense concrete with a surface of uniform texture. To aid in the placing of mixtures of a harsher consistency, mechanical vibration has been added in very recent years to these machines. This advancement permits the lowering of the water-cement ratio and makes possible a more economical use of cement.

MECHANICAL FINISHING FLOATS

Were it not for subsequent subsidence in the slab as the concrete is reaching its set, nothing further would have to be done following this compaction to insure a uniformly smooth surface. The subsidence, however, distorts the slab surface and occasional readjustments are necessary to correct the condition. This was accomplished by means of a series of long floats operated transversely across the pavement by hand and cutting and filling in the irregularities. The results obtained depended largely upon the skill of the individual operators.

In recent years a mechanical drag finisher has replaced the floats, and by numerous trips over the slab as it is taking its set, maintains the surface true to cross section. As a final precaution, a steel cut float is drawn over the hardened concrete to check and remove any slight irregularities that might yet remain.

Under earlier methods of pavement construction, it was considered necessary to use at least six sacks of cement to the cubic yard of concrete

to produce the desired minimum of strength under all of the variations in control existing at that time. Since the adoption of improved mechanical methods with their resulting uniformity of product, it has been practicable to reduce materially the amount of cement.

Mixtures generally consist of five sacks of cement to the cubic yard, and some have been placed with four and even three sacks per cubic yard. The early strengths of the lean mixtures are usually low; however, the three-sack mix has given average compressive strengths of 3600 pounds per square inch at a two-year age and has carried traffic for the entire period without sign of distress.

ASPHALT CONCRETE PAVEMENT

A great many changes have been made in recent years in the technique with which asphalt mixtures are designed, proportioned, and laid. The general design and scheme of operation of asphalt mixing plants is much the same today as it was thirty years ago. The changes that have been made were for the purpose of controlling uniformity and increasing production.

Mixing plants were formerly fed by teams and scrapers with the aggregate stockpiled in two sizes around the plant yard. The material went first to the dryer and then to a separation screen, where it was separated into two sizes and stored in bins above the mixer. As the uniformity in the grading of the material in the bins depended largely upon the care exercised in the blending and the feeding of the material to the dryer, the resulting mixture reflected largely the skill of the individual in charge of this feature. An attempt was made to overcome this difficulty by separating the material still further into a total of four sizes. This separation was a decided improvement; but it still left much to be desired and the manner of feeding was completely revised.

Belt feeding was required, and the aggregate, separated into the sizes roughly approximating the grading of material in each bin, is now fed onto the belt by controlled gates from bunkers or into a tunnel in the relative proportions used in the mixture. Although this innovation was criticized by the average operator when it appeared in specifications, it proved to be such an aid in increas-

ing average output that seldom will a contractor set up a plant (even on the low type of surfacing where it is not required) without making it a part of the installation.

HIGHER PENETRATION TYPES

Low-penetration asphalts were used in earlier mixtures, and because of a certain amount of subsequent raveling and cracking of these pavements, seal coats were provided for all projects. Since the present-day technique of applying such seal coats was unknown, they soon became glazed and were a serious traffic hazard in unfavorable weather. In order to overcome the objection from a service standpoint, the mixtures were revised and seal coats eliminated, but the former objections of lack of life reappeared. Research disclosed that lack of life was accompanied by loss of penetration in the asphalt, which immediately suggested that much higher penetration was desirable in the original asphalt. The present practice is to use asphalts of penetration ranging from 70 to 120 for this type of construction, and the results are very promising.

The spreading of asphalt concrete had always been performed by hand. Fifteen years ago experiments were

made with the modified mechanical spreading machines which were used at that time for portland cement concrete. After a year or two of perfecting, they became a success and are used universally wherever this type of construction is placed. The machines have since been designed and manufactured specially for this purpose.

THREE-AXLE ROLLERS ADOPTED

Steel-tired power rollers have been used throughout for compaction of this type of pavement. Minor improvements have been made from time to time in rolling equipment, the most noted of which is the comparatively recent innovation of three-axle rollers that permit a decided increase in concentration of load on isolated humps in the surface and act somewhat as a planer without removing any material or scarring the pavement.

The question of riding comfort has always been debatable since the first pavements were laid. Methods of evaluating this quality were under discussion for a great many years. In 1924 a means was developed whereby spring deflections of an automobile traversing a piece of pave-

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November Traffic on State Owned Bridges Totals 1,688,599 Vehicles

THE record of vehicular traffic on the San Francisco-Oakland Bay Bridge for the month of November shows a total of 1,384,735 of all classes of vehicles making a grand total of 1,688,599 of all vehicles using the three State-owned spans.

The recent reduction of tolls on the Carquinez and Antioch bridges was reflected in an increased traffic on those two spans. The total of all ve-

hicles using Carquinez and Antioch in November was 303,864 compared with 300,072, a gain of 3,792 and representing a considerable saving to owners. Passenger autos and auto trailers crossing the Carquinez bridge totaled 260,976 compared with 251,192 in October, and 16,178 on the Antioch bridge compared with 15,539 the preceding month. The total November traffic on the three bridges is shown in the following tabulation:

	San Francisco-Oakland Bay Bridge	Carquinez Bridge	Antioch Bridge
Passenger autos and auto trailers	1,276,130	260,976	16,178
Motorcycles and tricars	3,278	521	27
Buses	18,113	4,562	192
Trucks and truck trailers	66,139	19,094	2,179
Others	21,075	124	11
Total vehicles	1,384,735	285,277	18,587

700 Bridges on Military Road Network Inadequate

(Continued from page 2)

bridges operating under a material reduction of the normal safety factors. While some of the most dangerous bridges have been repaired or replaced during this biennium, the economic picture is not much improved because of the steady deterioration of substandard bridges already referred to.

700 INADEQUATE FOR ARMY

Now let us look at the situation on Military Roads alone.

The War Department recently requested that the Public Roads Administration, in cooperation with the States, make an estimate of the cost of bringing up to the desired standard, highways tentatively selected by them for their military importance.

It was found that there were about 1500 bridges on this military network in California and, although it included our best and most important State highways, there were 200 bridges that should be replaced and 500 more that should be strengthened. The estimated cost of doing this, exclusive of any road approach work, was about \$12,000,000, in addition to which there would be the cost of other bridges on extensions of highways not yet built.

It must be realized that even if money is provided for reconstructing these substandard bridges, they still can not be replaced over night. It would be necessary to make surveys to establish the proper highway location, to obtain foundation data and to prepare plans and specifications before construction can even be started. In the meantime, expensive repairs may have to be made and use of the highways continue to be limited by the reduced load limits at the bridges.

RESTRICTS HAULING

This limitation of the use of adjacent highways is a matter of general importance at all times. Very often the load limit on a bridge restricts hauling on many miles of highway because of the absence of alternative routes. If the capital investment in the roads is to pay its proper dividends, load restrictions on the bridges must be removed.

Accident Studies

The State highway system in California, as in most states, is divided into units of county, route and section, i.e. each route within a county is divided into convenient sections 10 to 20 miles long. The newly formed department under the direction of the safety engineer has charted the accident history of each section. On a reduced plan of each section, which shows alignment, accidents are plotted by means of circles, and at points where more than one accident occurs the circles are placed concentrically. This platting immediately shows up locations of repeated accidents.

For each such location detailed studies are then made of the accident reports, and the road conditions at the location are studied in both field and office to determine the part played by the road in the accident. From these studies it is possible in many instances to reach conclusions relative to faulty road conditions which may be corrected to eliminate the danger point.

With about 14,000 miles of road in the State system, the task of reducing this information to charts and plats is one of considerable magnitude.

Although heavy loads naturally occur more frequently on major traffic arteries, no road is immune from occasional loads of maximum and frequently more than maximum legal loads. Consequently all bridges, regardless of the importance of the road, must be designed and kept in condition to safely sustain these maximum loads, or else restrictions must be put upon them which will cause an economic hardship on the community dependent upon the road.

Unfortunately, even the best technically trained expert can not say definitely when a weak bridge will fail, for the principal reason that it is

governed to a large extent by the laws of probability or chance. The possibility of the right number of loads coming onto the bridge in just the right position to cause the greatest stress in every critical member must be assumed, but the probability of such an occurrence may be rather small. If it does not occur for many years, heavier single loads than that for which the bridge is posted may cross over with apparent safety and seem to discredit the engineer's computations.

RISK ALWAYS PRESENT

However, the risk is always there and it is well to remember that a bridge may be damaged by a heavy vehicle but not collapse until later on—perhaps under a vehicle that is far too light to cause any overstress in the structure. There have been many cases where State Highway bridges have been damaged to the point where their collapse could be expected momentarily. However, due to the constant inspection given to structures, whose strength is under suspicion, the condition has been observed in time to shore up the structure before it failed either under its own weight or a vehicle.

In concluding it seems advisable to stress the point that while old bridges stand a lot of abuse they have a habit of giving up at critical times, and when they do it means serious delay and an economic loss out of all proportion to the failure of any other link in highway transportation.

Also, bridge construction is expensive, so the investment should be as permanent a one as it is possible to make. It is, therefore, necessary that bridges be reconstructed in their final location, which means that a study and rebuilding of the adjacent highway must proceed simultaneously. Time is required to do this properly.

Finally, since it is necessary to build new roads, all funds available for construction can not be used for building bridges. The proportion of the funds now available that can be applied to bridge replacements and the accompanying road relocation, is so limited it will require many years to eliminate existing hazards.



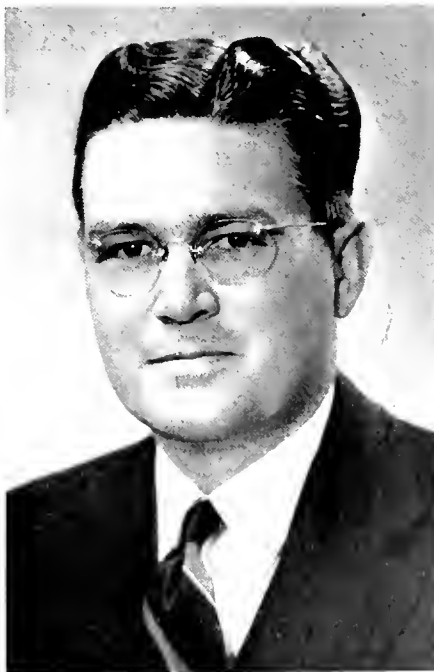
New bridge over Russian Gulch on Mendocino Coast has a 240-foot arch span.

Russian Gulch Bridge on the Mendocino Coast

THE coast of California is to a large extent extremely rugged, with deep gashes which must be crossed by the highway. Important structures are often required at these points in order to avoid long and winding detours around the head of the ravine or estuary.

The bridge over Russian Gulch on the Mendocino Coast Highway pictured on the cover and on this page is of a type that indicates economy in its construction but through its very simplicity of line harmonizes extremely well with the rugged scenery that frames it.

The 240-foot arch span, by no means the longest in the State, is still long enough to be worthy of note. It can be seen how it lends itself to the need for avoiding damage to footings which if placed in the stream bed always have been subjected to the force of the waves and



Ralph A. Tudor

the drift thrown up by the ocean during winter storms.

This arch bridge is a good example of how beauty can be attained without sacrifice of serviceability and economy.

Bay Bridge Engineer Tudor Goes into Army

Ralph A. Tudor, Principal Bridge Engineer of Maintenance and Operation of the San Francisco-Oakland Bay Bridge, has been given military leave of absence to join the Army on January 1. Mr. Tudor entered the service of the Bridge Department of the State Division of Highways in 1929 and was transferred two years later to the San Francisco-Oakland Bay Bridge Division in direct charge of construction, operation and maintenance.

Mr. Tudor graduated from West Point in 1923 and was in the regular Army serving one year in the Coast Artillery and five years in the Corps of Engineers before he came to California.

His rank in the Army will be Lieutenant-Colonel and he will be stationed at San Luis Obispo as Assistant to the Chief of Staff in Charge of Military Intelligence of the General Staff of the Fortieth Division.

He is a National Guard officer, not a Reserve officer.

Tentative Budget Estimate for Highway Construction \$36,341,230

TENTATIVE budget estimates for the 1941-43 biennial period were submitted to the California Highway Commission today by the Division of Highways and showed that there will be available for highway construction projects during the 93d and 94th fiscal years approximately \$36,341,230.

Highway revenues for the next biennium are estimated at \$90,600,000, which after allocations for administration, traffic engineering and special investigations, highway maintenance, maintenance of the Carquinez and Antioch bridges, highway planning survey, shops and equipment, and maintenance stations, major city streets, engineering, right of way, joint highway districts, one-quarter cent to cities for State highways and for the reserve and contingency funds will leave only \$36,341,230 for highway construction projects.

ESTIMATED REVENUE DETAILS

Estimated revenues are as follows: Gas Tax, \$73,000,000; Motor Vehicle Fees, \$8,474,000; Use Fuel Tax (Diesel), \$1,300,000; Federal Aid (1942-43), \$7,600,000; Caravan Fees, \$226,000; Total, \$90,600,000.

These revenues will be allocated generally as follows: Administration, \$3,900,000; Traffic Engineering and Special Investigation, \$325,000; General Maintenance, \$18,350,000; Maintenance of Carquinez and Antioch bridges, \$50,000; Highway Planning Survey, \$210,000; Capital Investment (shops and equipment) \$400,000, (maintenance stations) \$300,000; Major City Streets (1-cent allocation), \$9,125,000; Construction and Improvement, Engineering, Right of Way, Joint Highway Districts, City 1/4-Cent State Highways, Construction Projects, Reserve and Contingency Fund, \$57,940,000.

DIVISION NORTH AND SOUTH

The sum of \$57,940,000 will be divided between northern and southern California counties on the following basis:

For primary North highways, 54.26% of 50%, \$15,719,122; for primary South highways, 45.74% of 50%, \$13,250,878; total for primary highways, \$28,970,000.

For secondary North highways, 50% of 50%, \$14,485,000; for secondary South highways, 50% of 50%, \$14,485,000; total for secondary highways, \$28,970,000.

The total for Primary and Secondary highways in the North is \$30,204,122 and for Primary and Secondary highways in the South, \$27,735,878.

TENTATIVE CONSTRUCTION FUNDS

Tentative allocation of highway funds for construction and improvement is as follows:

	North		South	
	Primary	Secondary	Primary	Secondary
Preliminary Engineering -----	\$760,000	\$585,000	\$620,000	\$675,000
Construction Engineering -----	990,000	860,000	900,000	850,000
Right of Way -----	1,950,000	600,000	1,200,000	550,000
Joint Highway District -----	-----	200,000	-----	-----
City 1/4 Cent State Highway -----	1,878,071	1,733,604	1,764,264	3,749,061
Contingency and Reserve -----	560,596	349,611	395,804	427,759
Construction Projects -----	12,157,080	7,580,160	7,980,175	8,623,815
Totals -----	\$18,295,747	\$11,908,375	\$12,860,243	\$14,875,635

SUMMARY

PRIMARY NORTH -----	\$18,295,747	PRIMARY SOUTH -----	\$12,860,243
SECONDARY NORTH -----	11,908,375	SECONDARY SOUTH -----	14,875,635
	\$30,204,122		\$27,735,878

Viaduct in San Rafael

(Continued from page 10)

The slab spans as well as the girder spans are constructed on regular parabolic curves.

An electric conduit is installed throughout the structure to provide for the placing of luminaires in the future.

While present construction will provide for four lanes of traffic the viaduct is designed to allow for future widening.

The need for this project was evidenced by traffic counts taken in July, 1939, which showed 21,562 vehicles on Sunday and 12,538 on Monday near the south city limits of San Rafael. At the north city limits the counts were 19,441 and 10,298, respectively, for Sunday and Monday, indicating an average daily traffic of approximately 13,500 vehicles.

Well Meaning Old Lady: "Do you like to go to school, little boy?"

Small Boy: "Oh, going is all right, and coming back isn't so bad either. It's staying there between times that makes me so tired."

Evolution in Highway Construction Methods

(Continued from page 17)

ment were transmitted to an instrument installed in the car and recorded. Methods were soon worked out to calibrate these records and reduce them to a common basis of comparison.

To this one innovation the traveling public is indebted more than to any other development for the riding comfort built into the present-day pavement. The use of this rating device has created competition between engineers and contractors alike to obtain smoother and better work. The very efficient implements by which perfection is being obtained are but the result of such competition.

Prof: "What is the outstanding contribution that chemistry has given the world?"

Soph: "Blondes."

Teacher: "Johnny, in the Jones family there are the father, the mother, and the baby. How many does that make?"

Johnny: "Two, and one to carry."

Maintenance Equipment Study By National Highway Research Board

A SUBCOMMITTEE of the Maintenance Department of the National Highway Research Board has been designated to undertake a research study of maintenance equipment. The purpose of the study is to obtain accurate information on all of the various types of equipment which are available for performing highway maintenance work, and to recommend the most suitable and practical equipment for accomplishing particular operations.

This committee is composed of the following men:

T. H. Dennis (Chairman), Maintenance Engineer, Division of Highways, State of California.

A. A. Anderson, Manager, Highways and Municipal Bureau, Portland Cement Association.

H. K. Bishop, Chief, Division of Construction, U. S. Public Roads Administration.

Bernard E. Gray, Chief Engineer, The Asphalt Institute.

J. E. Lawrence, Maintenance Engineer, Department of Public Works, Massachusetts.

Rex M. Whitton, Maintenance Engineer, State Highway Department, Missouri.

The work of assembling the data necessary for the study is now under way. In order to insure a thorough canvass of the subject and to provide for a presentation of the data and the committee's recommendations in a useful and practical form for reference purposes, a method of procedure has been decided upon, which provides for the classification of all equipment into groups, according to its utility for performing specific operations.

TEN OPERATION GROUPS

As a basis for this classification, an outline of the study was prepared which groups all highway maintenance operations into ten major categories, as follows:

1. Maintenance of traveled way
2. Maintenance of shoulders
3. Maintenance of roadsides
4. Maintenance of bridges
5. Maintenance of miscellaneous structures

6. Snow removal, drift and ice control
7. Maintenance of trees, shrubbery and plantings
8. Maintenance of safety devices
9. Blasting
10. Miscellaneous

Each of these major categories is further broken down into various items of detailed work so that as many subheadings may be set up under each main classification as are necessary to fully cover the field. For example, under Topic 1, "Maintenance of traveled way," twelve subheadings have been listed, each representing the maintenance of one type of highway surfacing.

It is proposed to examine the equipment requirements for performing each item of work listed in the outline, and as far as is feasible, make definite recommendations as to the most practical type of equipment to use for each piece of work, and set up brief specifications for each unit of equipment. That is to say, it is proposed to set up suitable equipment, accompanied by controlling specifications, for performing the work under each main classification and each subheading of the outline.

ALL STATES COOPERATING

In a nationwide survey of this sort, it is of course obvious that suggestions and opinions concerning the equipment needed or considered desirable should be secured from as many sources and authorities as possible, in order that soil and climatic conditions in all sections of the country may be taken into account. The committee has therefore communicated with, and has solicited the cooperation of all of the State Highway Departments, and certain other public and private agencies which are interested in or are especially qualified or experienced in certain phases of maintenance work.

The opinions of the district engineers of the Public Roads Administration have been requested, and in addition, the Portland Cement Association is cooperating with regard to the maintenance of portland cement concrete highways and structures and the

Asphalt Institute is cooperating with respect to the maintenance of bituminous surface roads.

There will no doubt be considerable divergence in the suggestions offered by different authorities, and in the opinions received from different sections of the country. However, with a wide range of data at hand, the committee should be in a position to analyze each type and unit of equipment with reference to its utility for maintenance work.

TYPICAL EQUIPMENT SETUPS

In contacting the various states and other agencies, mimeographed copies of the outline of the study were forwarded, together with two exhibits, or sample setups, illustrating the type of information wanted and the manner in which it should be listed. One exhibit showed a typical setup recommended for maintaining an earth road, Topic 1-a in the outline, and the second showed a typical equipment setup recommended for the maintenance of steel bridges, Topics 4-a, b. These two exhibits, or typical equipment outfits accompanied by specifications, were in sufficient detail and in such a form as to readily illustrate the purpose and scope of the study.

All the agencies which have been contacted were requested to follow this form as closely as possible, in submitting their data, so that the information which is accumulated will be reasonably uniform and comparable, which will greatly assist the committee in analyzing the material and arriving at its recommendations.

It will probably be some time after the first of the year before the work of assembling this data is completed. Until all the information is received and studied, it is hardly possible to foresee what the scope of the committee's report will be. There will undoubtedly be a wide range of equipment recommended for performing the various maintenance operations, when the opinions from throughout the country are reviewed.

For example, the equipment setup recommended for maintaining an

(Continued on page 23)

Interstate Project Completed on California-Oregon Unit of U.S. 99

By F. W. HASELWOOD

OFFICIALS and citizens of Oregon and California gathered on the Pacific Highway at the State line on November 26, to celebrate the opening of a new and better highway and to dedicate it as another evidence of enduring friendship between the people of the two States.

Travel over the Siskiyou Mountains began over a century ago and has encountered the usual obstacles and handicaps leading up to the present triumph of road building.

History records that the first white man to cross the summit of the Siskiyou in Southern Oregon was Peter Skene Ogden on February 14, 1827. His diary records that he observed to the south a great white mountain comparable to Mt. Hood which he called Mt. Sastie.

FIRST WAGON TRAIN 1849

Captain Applegate, a hardy pioneer and Indian fighter who but recently died, took the first wagon train over the mountain pass in 1849.

Since that time traffic has remarkably increased although it by no means requires the oldest inhabitant to relate stories of hazard and hardship when a trip by either horse-drawn or motor vehicle between Yreka and Ashland was an adventure of several days duration. It is related that unsung pioneer poets were wont to express their sentiment in rhymes which were written on the signboard which informed the traveler that he had reached the Summit of the Siskiyou, a few of which read something like this:

"My feet emerge from wornout shoes,
Trying to cross the Siskiyou."

"I've got this far but t'aint no use,
I'll never get through the Siskiyou."

"This road is impassable,
It's not even jackassable.
If you must travel
Bring your own gravel."

In the short span of a generation remarkable changes have been wrought in what has become a major

artery of travel on the Pacific Coast, and a link in a great international highway which will eventually reach from Alaska to South America.

CEMENTED STATE FRIENDSHIP

The group that gathered at the State line between Yreka and Ashland on November 26 to dedicate the latest accomplishments of Oregon and California in improving the highway over and through the Siskiyou, brought from men yet young these memories of the past road conditions to compare with the excellence of the road now open for traffic. It cemented the friendship of the peoples of the two States in their mutual rejoicing over this evidence of cooperative effort. The major addresses of the occasion were made by State Highway Engineer R. H. Baldock and Governor Charles A. Sprague of Oregon.

At the beginning of the era of highway construction in California, Oregon had constructed and paved with asphaltic concrete a magnificent highway from Ashland to the State line, and California at once undertook to meet it with an equally serviceable road.

It is small wonder that roads laid out nearly thirty years ago, magnificent as they were in service to the traffic of that time, have long since become obsolete.

FINAL LOCATION IN 1938

In 1931 Oregon began to give serious consideration to the extreme urgency of improving their portion of the road over the Siskiyou, consisting of almost 21 miles from Ashland to the State line. In 1933 the first of 14 contracts was awarded for a valley section out of Ashland along the adopted route. The last of these contracts, which was for surfacing the section from a mile north of the Siskiyou Summit to the State line, was recently completed.

In 1932 the Division of Highways received inquiries from the Oregon

highway engineers as to whether it would be physically and financially possible for California to construct a new connection to meet their road at the State line, a point considerably lower and some distance west of the present State line connection.

The final location in both States was worked out in 1938 and financing was arranged so that the unit in California and the final work in Oregon would be completed at approximately the same time.

MAXIMUM GRADE 5.5%

The new highway in Oregon is 16 miles long, approximately 4.7 miles shorter than the old. It has maximum grades for southbound traffic of 5.5% and of 5% for northbound traffic. The minimum curve radius is 573 feet. The improvement in alignment has reduced the curvature from $35\frac{1}{2}$ to $5\frac{1}{2}$ complete circles. The graded road bed is 32 feet wide. Except for the valley section south of Ashland, which is paved with concrete, the road surface consists of 9 inches of crushed rock, ranging from $4\frac{1}{2}$ to 2 inches, placed in two layers the full width of the roadbed. Rock ranging from $\frac{3}{4}$ inch to dust is used as a choker on top of this base and the surface layer is constructed of bituminous macadam. Un-oiled crushed rock shoulders border the surface.

The total cost of the sixteen miles of new construction in Oregon was \$1,800,000, or about \$112,000 per mile.

To connect with Oregon's highway at the State line, California constructed 1.8 miles all on new location at a cost of \$123,000, or about \$68,000 per mile.

The minimum curve radius in the California unit is 1,432 feet and the maximum grade is 6%. The graded width is 36 feet. Base course is 6 inches of crusher run base over the entire grade with selected material from roadway cuts for subgrade. The

(Continued on page 28)



Views on newly completed section of U.S. 99 over the Siskiyou Mountains built by the States of Oregon and California. The combined cooperative project, 17.8 miles long, results in saving five miles in distance and at least thirty minutes traveling time

Sonoma Shore Line Improvements Eliminate 18 Unsafe Timber Bridges

By R. P. DUFFY, District Construction Engineer

WITH the contract awarded by Director of Public Works Frank W. Clark on June 4, 1940, to James E. Anderson of Visalia, for constructing a reinforced arch culvert on an improved alignment at McClellan Gulch on the Coast Highway about twenty-nine miles north of Jenner in Sonoma County, the last of the old timber bridges posted for restricted loading on this section of the State highway in District IV is being eliminated.

This section of roadway, from the mouth of the Russian River to the mouth of the Gualala River, extending for some forty miles along the Sonoma Coast, was transferred from the Sonoma County road system to the State Highway System by legislative action in 1933, at which time the surface was of native material, muddy and slippery in the winter, and dusty in the dry season. Shortly after becoming a part of the State Highway System, the surface was dust-oiled by the State forces, thereby providing a dustless summer and mudless winter route.

UNSAFE TIMBER BRIDGES

There were, however, some eighteen timber bridges across the numerous streams along this section that were designed for lighter than present-day standards, and were of such age that they had long passed their safe load capacity for even this light design.

State bridge engineers investigated all structures, and their findings dictated the necessity for legal posting for restricted loadings, although many minor repairs were made by State forces to allow maximum use of the structures pending available funds for their replacement.

In 1938 a contract was awarded to Parish Bros. of Oakland for the elimination of eight of the bridges, at a cost of \$49,000. These were replaced by seven redwood box culverts and one 90-inch multiplate pipe culvert on improved alignment, providing a 26-

foot oil-treated roadway. Where funds permitted these improvements were placed on the ultimate location of the road.

MAJOR LINE CHANGE

In 1939 a second contract, embracing 2.14 miles of grading a 26-foot oil-treated roadway, including the elimination of nine timber structures, was awarded to Guerin Bros. of San Francisco, at a cost of \$111,300. A major line change at Russian Gulch was included in this contract, crossing the stream in Russian Gulch below the forks, thereby replacing three poor, narrow timber bridges with one 3-span reinforced concrete bridge.

This line change, 1.17 miles in length, with a roadway width of 26 feet and oil-treated surface, on modern alignment and grade, replaces a narrow winding road along both sides of the canyon, shortening the distance 2,023 feet, reducing the curvature 806 degrees and providing an appreciable saving in driving time and comfort.

This location is especially noted for and secures its name from the Russian explorers and settlers who played an important part in its early history. Stories told by old-time residents of the area picture these explorers landing in the protected cove of Russian Gulch and traveling northward, settling at Fort Ross about 1812. The historic buildings and stockade, some of which have been restored, have been acquired by the State Park Department, and many visitors annually view these relics.

IMPROVEMENT ENDS RESTRICTIONS

At other points along this road evidence can be seen of early day lumbering activities, including portions of old ship loading rigs where ships were anchored off shore to secure their lumber cargo by high lines between the shore and the ship. Some lumber is still produced in the hills to the east of the road, but due to restricted

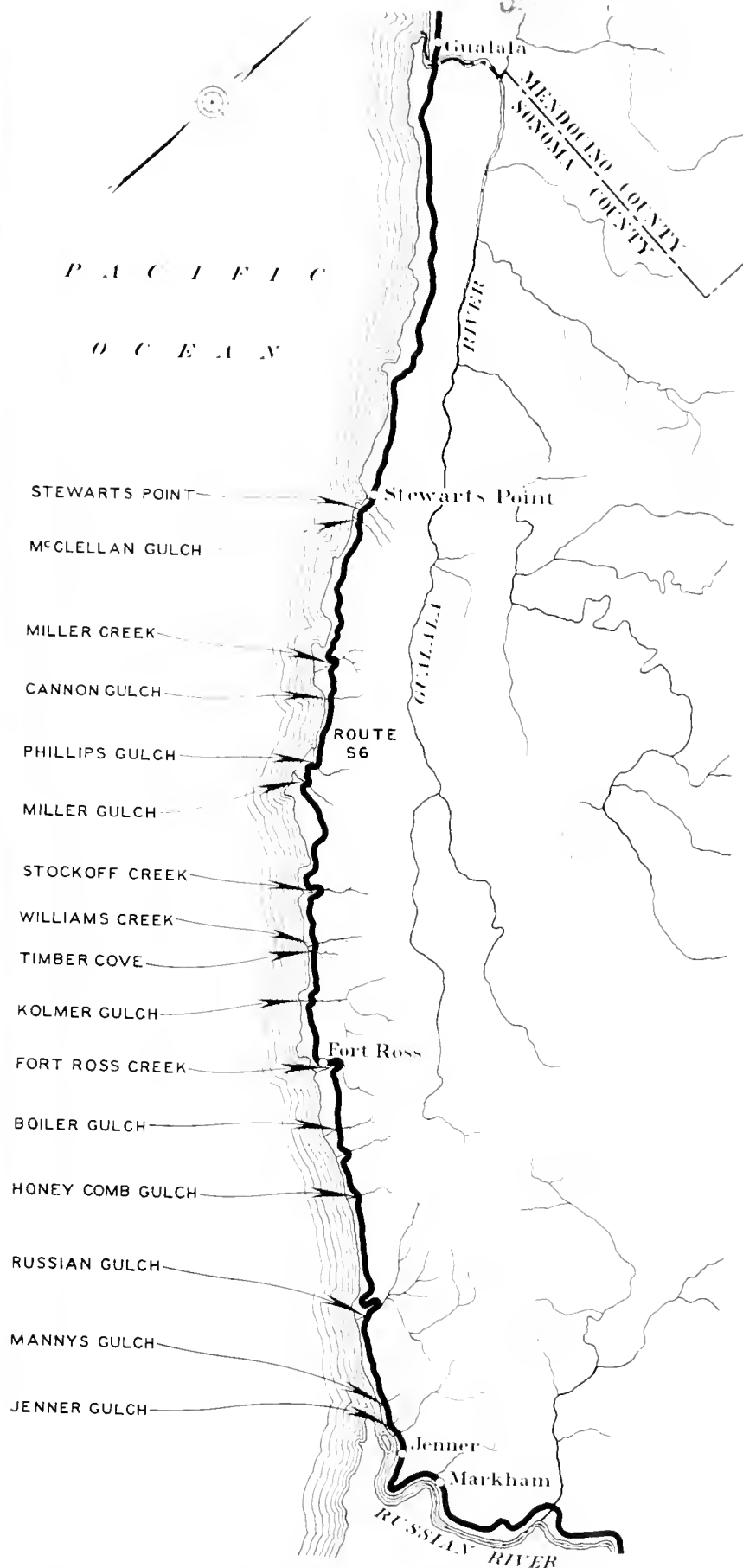
loadings on the old timber structures and the short radius curves at many of the bridge approaches, hauling of this product was severely restricted.

The elimination of these restrictive features by the recently completed highway construction along this route has removed this barrier from that industry.

The work on Guerin Bros. contract was completed in June, 1940. This same month, a third contract was awarded to James E. Anderson of Visalia, at a cost of \$23,500, for the elimination of McClellan Gulch Bridge near Stewart's Point, as noted at the commencement of this article. This contract is now under way and upon completion thereof, the last of the old timber bridges which were posted for restricted loading will have been eliminated on this section of highway in Sonoma County.

Names of the bridges replaced under the foregoing contracts are shown on our records as:

1. Boiler Gulch Bridge, replaced with 90-inch multiplate culvert.
2. Fort Ross Creek Bridge, replaced with redwood box culvert.
3. Kolmer Gulch Bridge, replaced with redwood box culvert.
4. Williams Creek Bridge, replaced with redwood box culvert.
5. Stockoff Creek Bridge, replaced with redwood box culvert.
6. Miller Gulch Bridge, replaced with redwood box culvert.
7. Phillips Gulch Bridge, replaced with redwood box culvert.
8. Miller Creek Bridge, replaced with redwood box culvert.
9. Three bridges over forks of Russian Gulch, replaced by a single 3-span reinforced concrete bridge.
10. Jenner Gulch Bridge, replaced by corrugated metal pipes.
11. Manny's Gulch Bridge, replaced by corrugated metal pipes.



12. Honey Comb Gulch Bridge, replaced by R. C. arch culvert.
13. Cannon Gulch Bridge, replaced by R. C. arch culvert.
14. Timber Cove Bridge, replaced by tunnel through native rock bluff.
15. Stewart's Point Bridge, replaced by R. C. arch culvert.
16. McClellan Gulch Bridge, now being replaced by R. C. arch culvert.

GEORGE A. SEDGWICK GOES TO PANAMA CANAL COMMISSION

George A. Sedgwick has resigned from the Division of Architecture to accept a position as Associate Engineer with the Panama Canal Commission.

Mr. Sedgwick served 11 years with the State prior to his resignation, joining the Harbor Board in San Francisco in 1929, the Bridge Department of the Division of Highways in 1933, and the Division of Architecture in 1937. He has been connected with several major projects, including the structural design of the new Professional and Vocational Standards Building in Sacramento, and the Big Creek arch bridge on the San Simeon-Carmel coast route 56.

Mr. Sedgwick graduated from the University of California in 1927, receiving his degree in the College of Civil Engineering. He is a registered Civil and Structural Engineer in California, an associate member of American Society of Civil Engineers, and holds membership in the honorary engineering fraternities Tau Beta Pi and Chi Epsilon.

Mr. Sedgwick will be missed by his fellow engineers, especially at various annual banquets where his success as a toastmaster is unparalleled.

PLEASURE TO RECEIVE

Bank of America,
San Diego, California.

Editor,
California Highways
and Public Works,
Sacramento, California.

Dear Sir:

It is always a pleasure to receive your very educational magazine which so clearly shows the development of California's highways and natural resources.

I commend and congratulate you for this splendid publication.

Sincerely,

A. V. MAYRHOFER,
Assistant Vice President.

Bay Bridge Five Times Safer for Traffic Than Average Highway

THE chances of a person being either injured or killed in a motor vehicle accident on the San Francisco-Oakland Bay Bridge are about one-half what they would be on the average highway in California or the nation, according to a report of State Highway Engineer C. H. Purcell made to Director of Public Works Frank W. Clark.

Mr. Purcell's report comprised data submitted in advance of a proposed conference with James M. Carter, Director of Motor Vehicles, and E. Raymond Cato, Chief of the California Highway Patrol, for the purpose of discussing ways and means for increasing traffic safety on the bay bridge.

In his report, Mr. Purcell said: "The Bay Bridge is the heaviest traveled toll structure in the world and one of the busiest of all highways. At the same time it is one of the safest, and a 4-year record shows that the chances of a person being either injured or killed on the bridge are about one-half what they would be on the average highway in the State or the nation. For the past 12 months even this record has been improved to the point where the relative chance of being killed in an accident on the bridge has been 1 to 5½ on the average highway.

"In 1938 a person could drive about 7,040,000 miles in California, or 8,020,000 miles throughout the

United States, before expecting to be killed in an accident. In four years on the bridge he could have traveled 14,600,000 miles before anticipating a comparable fate. In the last year his chances on the bridge were far better and he could enjoy 39,000,000 life-safe miles.

"In 1938 the same person could drive an average of 380,000 miles on California highways before expecting to be injured in an accident. For the past four years he could drive 775,000 miles on the bridge before taking the same risk. In the last 12 months his chances on the bridge were not quite so good and he could expect injury after 625,000 miles.

"The accompanying table gives these facts in greater detail:

	United States for 1938	California for 1938	Bay Bridge	
			Since opening Nov. 12, 1936 to Oct. 31, 1940	Last 12 months October, 1939 to October, 1940
1. Vehicle miles	260,000,000,000	19,500,000,000	236,000,000	78,000,000
2. Total personal injury and fatal accidents	-----	36,643	151	72
3. Fatal accidents	-----	2,550	10	2
4. Persons killed	32,400	2,775	16	2
5. Persons injured	-----	51,150	302	125
6. Vehicle miles per personal injury or fatal accident	-----	531,000	1,550,000	1,080,000
7. Vehicle miles per fatal accident	-----	7,650,000	23,600,000	39,000,000
8. Vehicle miles per fatality	8,020,000	7,040,000	14,600,000	39,000,000
9. Vehicle miles per injury	-----	380,000	775,000	625,000

London Library Carries on With Magazine Files

German bombers over London evidently have not interfered with the orderly work of the Science Museum Library, South Kensington, in England's capital city.

The mail from overseas brought to Director of Public Works Frank W. Clark today a letter from E. Hamorten-Jones, Keeper of the Library at the Museum, requesting several back issues of CALIFORNIA HIGHWAYS AND PUBLIC WORKS, the official magazine of the Department of Public Works. Jones wrote:

"With reference to CALIFORNIA HIGHWAYS AND PUBLIC WORKS which you have kindly forwarded to the National Library of Science and

Technology at this Museum, I beg to inquire whether you would be so good as to supply copies of Volume 18, Nos. 1 to 3 and 7 to 9 and onwards, which have not been received, in order that the library set may be complete to date."

The Science Museum Library is a National Central Library of pure and applied science. The Library contains works printed in Great Britain and the more important scientific books published abroad, and, in addition, an exceptionally extensive collection of current scientific and technical periodicals of all countries. It is particularly rich in the transactions of societies, bulletins, monographs, reports, etc., of government departments, experiment stations, research laboratories, and scientific institutions. The total number of peri-

odicals in the library is about 15,000, of which some 10,000 are current. The number of volumes in the library is approximately 280,000, and is being augmented at the rate of 12,000 a year.

USED IN CLASSES

San Diego, Calif.

Dear Sirs:

I use your magazine in my social science classes. We took a lot of our units on conservation and transportation from the California Highway numbers. I assign articles to the various students and then they give oral reports on what they have read. I do enjoy your magazine.

RALPH M. YOUNG,
Social Science Teacher,
Herbert Hoover Sr. High School

Highway Bids and Awards for the Month of November, 1940

ALAMEDA COUNTY—Silver Springs highway crossing under the tracks of the Western Pacific Railroad at Sunol to be constructed. District IV, Route 107, Section A. A. Soda & Son, Oakland, \$148,764; Piazza & Huntley & Trewitt, Shields & Fisher, San Jose, \$150,265; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$150,435; Lee J. Immel, Berkeley, \$163,727; Fred J. Maurer & Son, Eureka, \$164,587. Contract awarded to Earl W. Heple, San Jose, \$139,067.

DEL NORTE COUNTY—Embankment stabilization, 4.5 miles south of Crescent City, District I, Route 1, Section B. Claude C. Wood, Lodi, \$13,772; Fred J. Maurer & Son, Eureka, \$15,476; John Burman & Sons, Eureka, \$16,263. Contract awarded to Mercer Fraser Co., Eureka, \$12,325.

FRESNO-MADERA COUNTY—Remove existing bridge across San Joaquin River about 10 miles north of Fresno, District VI, Route 125, Sections C. A. Louis Biasotti & Son, Stockton, \$2,950; Fred Fredenburg, So. San Francisco, \$3,500; J. L. Webster, Stockton, \$4,700; M. A. Jenkins, Sacramento, \$5,220; George E. France, Visalia, \$8,000. Contract awarded to Kiss Crane Service Co., Berkeley, \$2,750.

KERN COUNTY—Between San Luis Obispo County line and 0.2 mile south of Kings County line, about 4.7 miles to be graded and road-mix surface treatment applied. District VI, Route 125, Section A. Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$123,241; Brown Materials Co., Ltd., Avenal, \$126,284; Louis Biasotti & Son, Stockton, \$130,169; J. E. Haddock, Ltd., Pasadena, \$138,829; A. Teichert & Son, Inc., Sacramento, \$146,877; Basich Brothers, Torrance, \$156,312. Contract awarded to Griffith Co., Los Angeles, \$119,371.

KERN COUNTY—Two bridges to be constructed, one across Kern River and the other across Beardsley Canal about one and two miles, respectively, north of Bakersfield, District VI, Route 142, Section A. R. R. Bishop, Long Beach, \$192,565; Carlo Bongiovanni, Hollywood, \$192,877; Griffith Co., Los Angeles, \$193,275; A. Soda & Son, Oakland, \$195,321; Trewitt-Shields & Fisher, Fresno, \$199,969; J. E. Haddock, Ltd., Pasadena, \$210,487; Ralph A. Bell, San Marino, \$201,924; Heafey-Moore Co. & Fredrickson & Watson Const. Co., Oakland, \$207,620; Harry J. Oser, San Francisco, \$214,030. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$192,339.

LOS ANGELES COUNTY—In Arcadia at Huntington Drive between Second and Third Avenues, an undergrade crossing under the tracks of the Atchison, Topeka & Santa Fe Ry. to be constructed and approaches about 0.1 mile in length to be graded and surfaced with asphalt concrete. District VII, Route 161, Section Ada. Byerts & Dunn, Los Angeles, \$165,414; Griffith Co., Los Angeles, \$168,740; Oscar Oberg, Los Angeles, \$172,492; Carlo Bongiovanni, North Hollywood, \$175,172; Baruch Corp., Los Angeles, \$185,276; Oswald Bros., Los Angeles, \$189,019; United Concrete Pipe Corp., Los Angeles, \$193,408; Sander Pearson, Santa Monica, \$194,204; Mitty Bros. Construction Co., Los Angeles, \$205,145. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$163,659.

LOS ANGELES COUNTY—At Newhall Station California Highway Patrol, truck scale to be furnished and installed. District VII, Route 79, Section B. Fairbanks

Morse & Co., Los Angeles, \$1,906. Contract awarded to Toledo Scale Co., Toledo, Ohio, \$4,299.

LOS ANGELES COUNTY—Chilao Maintenance Station Angelus Crest Highway, about 26 miles north of junction with Foot-hill Blvd. Sanitary plumbing for 34 room dwellings and one truck shelter to be furnished and installed. District VII, Route 61, Section C. Hickman & Ritter, Pasadena, \$1,407; Earl O. Stice Co., Los Angeles, \$1,619; Edw. H. Martin, Los Angeles, \$1,201. Contract awarded to Adolph Gronlund, La Crescenta, \$836.

LOS ANGELES COUNTY—Chilao Maintenance Station at above location. Electrical wiring. Magee Electric Co., Glendale, \$538; H. O. Banerle, Los Angeles, \$949. Contract awarded to G. A. Pjeltstrom, Glendale, \$532.

SAN BENITO, SANTA CLARA COUNTIES—Between Prudale junction and Sargent overhead, about 2.6 miles to be graded and surfaced with plant-mixed surfacing. District IV, Route 2, Sections A. C. Maceo Construction Co., Clearwater, \$136,111; N. M. Ball Sons, Berkeley, \$138,828; Earl W. Heple, San Jose, \$145,738; Louis Biasotti & Son, Stockton, \$146,915; Union Paving Co., San Francisco, \$147,597; Gibbons & Reed Co., Burbank, \$149,452; A. Teichert & Son, Inc., Sacramento, \$142,653. Contract awarded to Heafey-Moore Co. and Fredrickson & Watson Construction Co., Oakland, \$131,221.

SAN JOAQUIN COUNTY—In the city of Stockton, on North Wilson Way, about 0.17 mile to be paved with asphalt concrete. District X, Route 4, Section Stkn. M. J. B. Construction Co., Stockton, \$8,915. Contract awarded to S. M. McGaw, Stockton, \$8,565.00.

SANTA CLARA, SAN BENITO COUNTIES—Across Pajaro River six miles south of Gilroy, a steel girder bridge on concrete piers and abutments, having a length of 340 feet, to be constructed. District IV, Route 2, Sections C. A. Trewitt-Shields & Fisher, Fresno, \$128,780; A. Soda & Son, Oakland, \$129,485; Earl W. Heple, San Jose, \$136,222; Joseph Shaw, Crescent City, \$140,358; Harry J. Oser, San Francisco, \$146,489; United Concrete Pipe Corp., Los Angeles, \$159,501. Contract awarded to C. W. Calletti & Co., San Rafael, \$124,081.

SANTA CLARA COUNTY—University Avenue underpass in Palo Alto, about 0.14 mile to be landscaped. District IV, Feeder route, Section P. A. Leonard Coates Nurseries, San Jose, \$4,598. Contract awarded to California Nursery Co., Inc., Niles, \$2,445.

SANTA CRUZ COUNTY—Between Day-enport and 1½ miles south, about 1.0 mile to be graded and road-mix surface applied. District IV, Route 56, Section B. A. Teichert & Son, Inc., Sacramento, \$56,490; Louis Biasotti & Son, Stockton, \$58,318; N. M. Ball Sons, Berkeley, \$61,685. Contract awarded to Heafey-Moore Co. and Fredrickson & Watson Construction Co., Oakland, \$52,994.

STANISLAUS COUNTY—Between Keyes and Hatch Crossing, about 5.5 miles to be graded, portions to be paved with portland cement concrete, portions to be surfaced with plant-mixed surfacing on portland cement concrete base, borders of crusher run base to be constructed adjacent to the new pavement, and a reinforced concrete bridge to be constructed. District N. Route

1, Section A, Cer. B. Fredericksen & Westbrook, Sacramento, \$222,292; Basich Bros., Torrance, \$224,102; N. M. Ball Sons, Berkeley, \$229,152; A. Teichert & Son, Inc., Sacramento, \$236,817; Union Paving Co., San Francisco, \$238,208; Heafey-Moore Co. & Fredrickson & Watson Const. Co., Oakland, \$244,420; United Concrete Pipe Corp., Los Angeles, \$249,273. Contract awarded to M. J. B. Construction Co. and P. Kaus, Stockton, \$213,980.

TULARE COUNTY—Across Cameron Creek about five miles east of Visalia, a reinforced concrete slab bridge. District VI, Route 10, Section C. J. L. Webster, Stockton, \$10,318; Trewitt-Shields & Fisher, Fresno, \$10,737; James E. Anderson, Visalia, \$14,175; George E. France, Visalia, \$14,674; L. D. Tonn, Lodi, \$12,754. Contract awarded to Louis Biasotti & Son, Stockton, \$10,000.

TULARE COUNTY—Across Sand Creek about 0.5 mile south of Orosi, a reinforced concrete slab bridge. District VI, Route 132, Section C. Fred Fredenburg, So. San Francisco, \$8,199; Brown & Doko, Pismo Beach, \$8,301; Trewitt-Shields & Fisher, Fresno, \$8,551; Louis Biasotti & Son, Stockton, \$8,714; James E. Anderson, Visalia, \$9,612; A. A. Tieslau, Berkeley, \$10,316; A. H. Siemer & J. Carcano, San Anselmo, \$10,425. Contract awarded to Thomas Construction Co., Burbank, \$7,733.

TUOLUMNE COUNTY—Between Columbia Wye and Sonora, about 1.9 miles to be graded and surfaced with road-mix surfacing on crushed rock or gravel base. District X, Route 65, Section A. Sra. Poulos & McEwen, Sacramento, \$95,672; Louis Biasotti & Son, Stockton, \$96,145; Claude C. Wood, Lodi, \$109,796; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$112,424; A. Teichert & Son, Inc., Sacramento, \$120,385. Contract awarded Johnston Rock Co., Inc., Stockton, \$87,465.

VENTURA COUNTY—At Camarillo State Hospital, near Camarillo, roads within hospital grounds to be graded, surfaced with plant-mixed surface on imported subgrade material and portland cement concrete curbs, gutters, and sidewalks. J. E. Haddock, Ltd., Pasadena, \$30,887; Griffith Co., Los Angeles, \$30,911. Contract awarded to Sander Pearson, Santa Monica, \$30,772.

YOLO COUNTY—Between Swingle and Yolo Causeway, about 1.5 mile, south lane of a divided highway to be graded. District III, Route 6, Section A. B. A. Teichert & Son, Inc., Sacramento, \$34,987; Piazza & Huntley, San Jose, \$40,190; Kiss Crane Service, Berkeley, \$47,758; Shea & Beebe, Hawthorne, \$49,666; Lee J. Immel, Berkeley, \$49,940; J. R. Reeves, Sacramento, \$53,223. Contract awarded to Fredericksen & Westbrook, Sacramento, \$34,031.

October Awards

SAN BERNARDINO COUNTY—Between Redlands and three miles east, about three miles to be graded and surfaced with surfacing material. District VIII, Route 26, Section Rd. B. Matich Bros., Elsinore, \$69,476; Oswald Bros., Los Angeles, \$71,253; E. L. Yeager, Riverside, \$72,247; Griffith Co., Los Angeles, \$75,418; A. S. Vinnell Co., Alhambra, \$85,944. Contract awarded to Dimmitt & Taylor, Los Angeles, \$63,367.

SAN MATEO COUNTY—Between Edgemoor and Thornton, about 0.6 mile to be graded and surfaced with road-mix surfacing on pit run base. District IV, Route

56, Section E. Maceo Construction Co., Clearwater, \$25,800; N. M. Ball Sons, Berkeley, \$28,760; Louis Biasotti & Son, Stockton, \$29,914; Frederickson & Westbrook, Sacramento, \$29,474; Heafey-Moore Co. & Frederickson & Watson Construction Co., Oakland, \$33,472; A. Teichert & Son, Inc., Sacramento, \$34,863; Xenophon Carithers, San Mateo, \$49,029. Contract awarded to Piombo Bros. & Co., San Francisco, \$23,185.

SAN MATEO COUNTY—Between Broadway and Charter Streets in Redwood City, about 1.3 miles to be graded and paved with asphalt concrete. District IV, Route 2, Section Rdw.C. Marshall S. Hanrahan, Redwood City, \$210,832; Chas. L. Harney, San Francisco, \$228,795. Contract awarded to Piazza and Huntley and Trewhitt-Shields and Fisher, San Jose, \$209,302.

SAN MATEO COUNTY—Between Rockaway Beach and Edgemar, about 3.2 miles to be graded and surfaced with plant-mixed surfacing. District IV, Route 56, Section E. N. M. Ball Sons, Berkeley, \$88,260; Piombo Bros. & Co., San Francisco, \$89,711; Frederickson & Westbrook, Sacramento, \$95,923; Heafey-Moore Co. & Frederickson & Watson Construction Co., Oakland, \$98,457; Maceo Construction Co., Clearwater, \$99,513; Chas. L. Harney, San Francisco, \$109,884; Union Paving Co., San Francisco, \$112,738. Contract awarded to A. Teichert & Son, Inc., Sacramento, \$76,023.

SANTA BARBARA COUNTY—Between Orrella and one mile west of Canada del Refugio, about 2.0 miles to be graded and surfaced with plant-mixed surfacing and a reinforced concrete girder bridge to be constructed. District V, Route 2, Section F. J. E. Haddock, Ltd., Pasadena, \$197,868; A. Teichert & Son, Inc., Sacramento, \$202,434. Contract awarded to Basich Brothers, Torrance, \$170,717.

SANTA CLARA COUNTY—Between Llagas Creek and Gilroy, about 5.6 miles to be graded and paved with asphalt concrete and portland cement concrete. District IV, Route 2, Section C. Maceo Construction Co., Clearwater, \$186,273; Frederickson & Westbrook, Sacramento, \$189,537; Heafey-Moore Co. and Frederickson and Watson Construction Co., Oakland, \$195,057; J. E. Haddock, Ltd., Pasadena, \$215,151. Contract awarded to N. M. Ball Sons, Berkeley, \$181,632.

Maintenance Equipment Study by Research Board

(Continued from page 21)

earth road under California soil and climatic conditions, that is, average conditions in one state, includes five alternatives for performing the work of shaping and blading. Whether a single type of equipment should be recommended for a certain piece of work, or whether alternative types of equipment should also be suggested, will have to be determined by analysis of the data and circumstances.

The plan under which this study is proceeding should permit the compilation of quite a complete and comprehensive text on maintenance equipment. The work probably will be concluded and a report submitted during 1941.

In Memoriam

Richard Barry, Assistant Resident Engineer, was laid to rest in Holy Cross Cemetery in San Francisco, after his death at Red Bluff on November 16, 1940.

Mr. Barry was born in Inagh, County Clare, Ireland, on February 26, 1884, where he received his early education in the Inagh National School. Coming to America in his youth he entered the Preparatory School of Notre Dame University, continuing in the College of Civil Engineering at Notre Dame and at the Ohio State University.

Mr. Barry first entered the service of the State in September, 1921, and was employed on two short assignments. He reentered the service in 1929 in District II and continued as an employee until his death.

During the summer of 1939, Mr. Barry and his brothers and sisters enjoyed a family reunion in Ireland; returning shortly before the war made sea travel dangerous.

He is survived by two sons, Hubert M. and Richard M.; his sisters, Mrs. Mary Cullen of Chicago, Mrs. Martin Halloran of New York, Mother Mary Gerald, Mother General, Dominican Sisters, Adrian, Michigan; and his brothers, Michael Barry of Inagh, Ireland, Reverend Joseph B. Barry of Biri, Ireland, Frank J. Barry, Los Angeles, John Barry, Redding and Mons. Wm. Barry, Vicar General, St. Augustine Diocese, Miami, Florida.

His untimely death, due to an automobile accident near Redding, California, on November 14, was a shock to his associates in the Division of Highways. Always a loyal and conscientious worker, he made friends with superiors and subordinates alike. His happy personality will be long remembered by his co-workers.

T. V. A. ENGINEER REQUESTS

Knoxville, Tenn.

California Highways and Public Works, Sacramento, California.

Gentlemen:

I should appreciate being added to your mailing list to receive copies of the magazine "California Highways and Public Works." I have been reading the magazine regularly through the courtesy of a friend, but now that he has left town, this opportunity is no longer available.

Your kindness will be greatly appreciated.

Very truly yours,

M. L. DICKINSON,
Hydraulic Engineer,
Tennessee Valley Authority,
Knoxville, Tennessee.

Project Completed on California-Oregon Unit

(Continued from page 22)

surface consists of dense graded plant mix .15 by 22 feet covered with .06 by 22 feet of open graded plant mix producing a nonskid surface. Shoulders are covered with dense graded plant mix one-tenth of a foot thick.

SAVES 5 MILES

This combined cooperative project 17.8 miles long results in a gross saving of 5 miles in distance and at least 30 minutes in traveling time and provides an infinitely safer road. Full credit for this major improvement of the Pacific Highway is due to Oregon highway officials and engineers for their vision in conception of the project and their broad viewpoint in dealing with the problems involved.

At other locations in both California and Oregon work of modernizing obsolete sections of the Pacific Highway will continue as rapidly as funds are available.

Governor Culbert L. Olson and Director of Public Works Frank W. Clark were represented at the opening ceremonies by Secretary Walter L. Ballou of the California Highway Commission and State Highway Engineer C. H. Purell by Construction Engineer R. M. Gillis of the State Division of Highways.

Gov. Olson Discusses Highway Development

(Continued from page 13)

must be increases in Federal assistance to the States if the program is to advance with the speed which is necessary.

The next ten years in highway development place before State and Federal officials a challenge which must be squarely met if the nation is to be provided with the highway facilities to which it is entitled.

KEEPING INFORMED

Sirs:

Kindly place us on your mailing list to receive journal CALIFORNIA HIGHWAYS AND PUBLIC WORKS.

One million miles of highway travel in the last eighteen years in California makes us appreciate the work your division has done. We desire to keep up with the progress to be made. Thanks.

M. D. and S. L. CLARK,
Loomis, California.

State of California

CULBERT L. OLSON, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

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FRANZ R. SACHSE, Assistant Director

MORGAN KEATON, Deputy Director

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R. H. WILSON, Office Engineer
T. E. STANTON, Materials and Research Engineer
FRED J. GRUMM, Engineer of Surveys and Plans
R. M. GILLIS, Construction Engineer
T. H. DENNIS, Maintenance Engineer
F. W. PANHORST, Bridge Engineer
L. V. CAMPBELL, Engineer of City and Cooperative projects
R. H. STALNAKER, Equipment Engineer
J. W. VICKREY, Safety Engineer
E. R. HIGGINS, Comptroller

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F. W. HASELWOOD, District II, Redding
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S. V. CORTELYOU, District VII, Los Angeles
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EDWARD HYATT, State Engineer, Chief of Division
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A. D. EDMONSTON, Deputy in Charge Water Resources Investigation
GEORGE W. HAWLEY, Deputy in Charge Dams
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GORDON ZANDER, Adjudication, Water Distribution

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P. T. POAGE, Assistant State Architect

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C. H. KROMER, Principal Structural Engineer
CARLETON PIERSON, Supervising Specification Writer
J. W. DUTTON, Principal Engineer, General Construction
W. H. ROCKINGHAM, Principal Mechanical and Electrical Engineer
C. E. BERG, Supervising Estimator of Building Construction

DIVISION OF CONTRACTS AND RIGHTS OF WAY

C. C. CARLETON, Chief
FRANK B. DURKEE, Attorney
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ROBERT E. REED, Attorney



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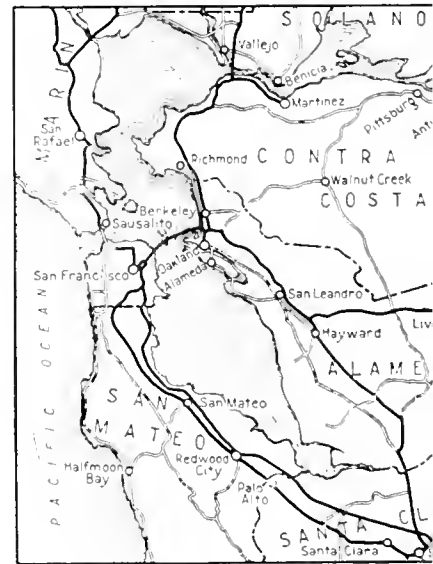
SCALE IN MILES

0 50 100

~ LEGEND ~

Primary Routes
Secondary Routes
Proposed Routes

SAN FRANCISCO AND VICINITY



LOS ANGELES AND VICINITY



